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* * *

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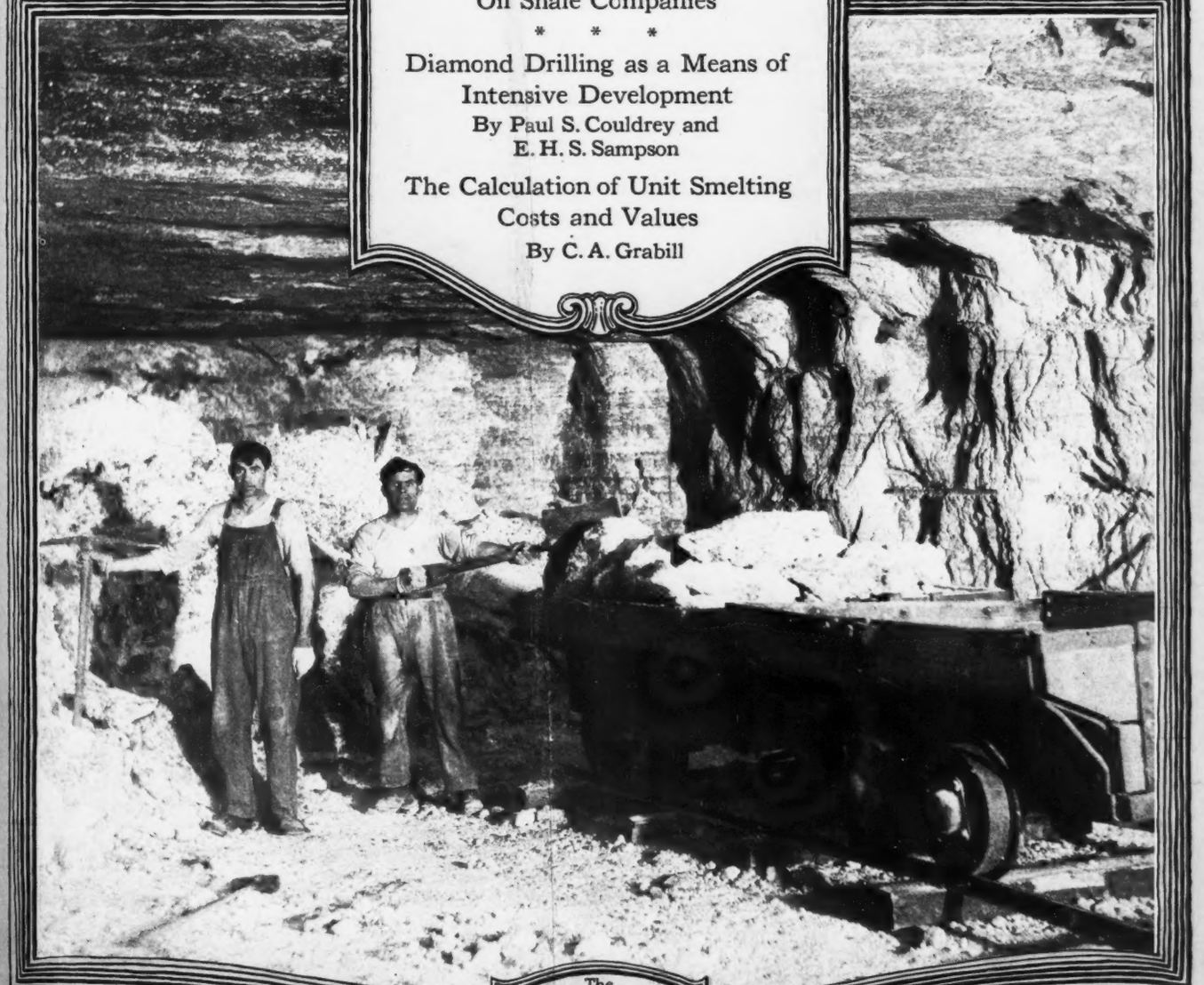

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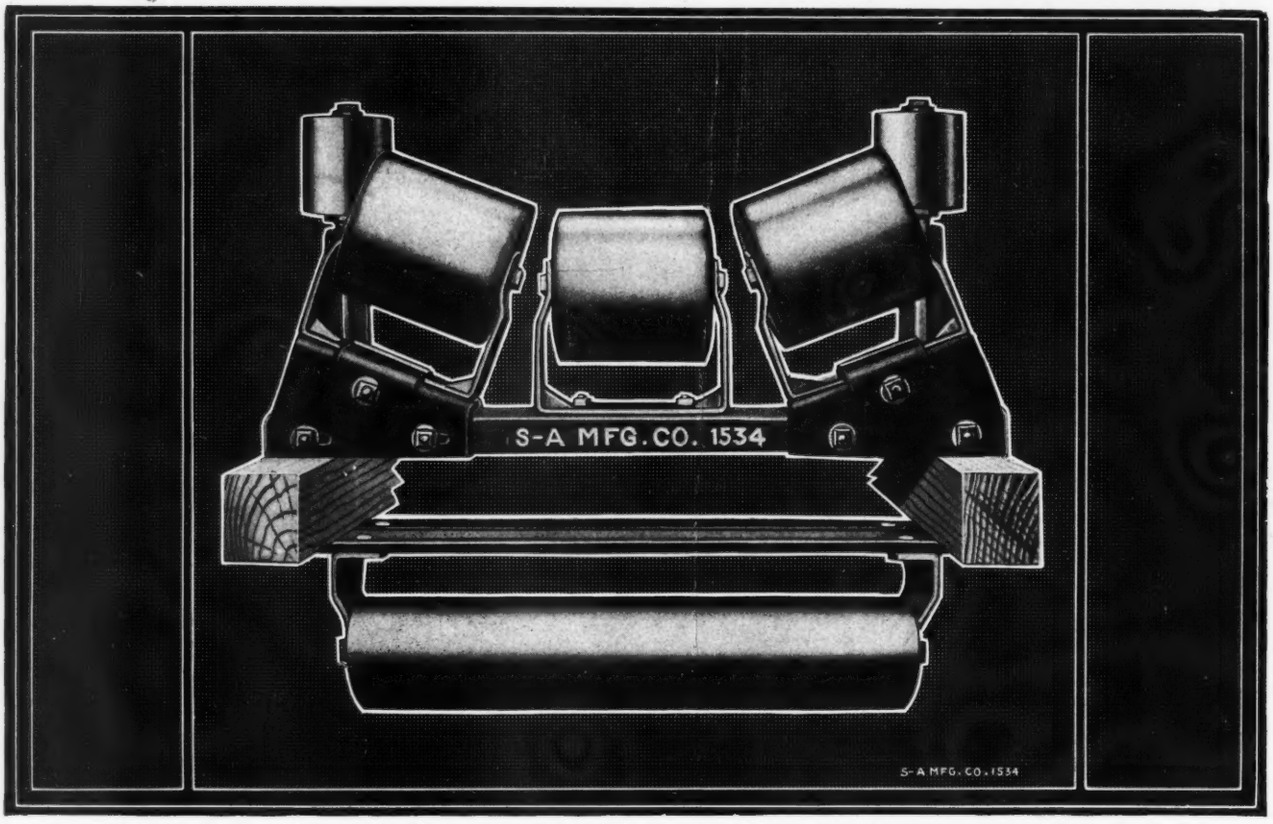

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Volume 110 **New York, September 25, 1920** *Number* 13

The Directorship of the Bureau of Mines

IT IS NO SECRET that the present gifted and deservedly popular Director of the Bureau of Mines accepted the position only with a desire to do temporary service; and that he is desirous to quit it at an early date to take up again the research work to which he has devoted himself with such remarkable results. The question as to who is to be his successor is therefore an imminent one. As he will probably be reasonably permanent, there is a strong feeling in the mining industry that the new director should represent that industry, by reason of his experience, in the broadest and most understanding way.

The Geological Survey, the complement and sometimes the rival of the Bureau of Mines, has always had at its head able and distinguished geologists—Powell, Wolcott, and the present Director, George Otis Smith. The Bureau of Mines, on the other hand, has never had at its head a man personally familiar with mining; and we believe that the program and history of the Bureau has reflected this unfamiliar and purely academic quality.

The problems of the mining industry are manifold, broad, and increasingly significant; and the man who, as the head of the Bureau of Mines, weighs them and determines the policy and program of the Bureau should be a super-mining-engineer, just as the head of the Department of Justice must be a super-jurist, and by no chance a physician. We, therefore, recommend to our mining societies, such as the Institute of Mining Engineers, the Mining and Metallurgical Society, and the American Mining Congress, that they carefully investigate this matter and formally advise the Secretary of the Interior of their conclusions. Hitherto the succession has been purely bureaucratic: the second Director had been Chief Clerk of the first administration; and the present Director was Chief Metallurgist of the second administration. A clear perspective demands a new and independent point of view from without, such as can be brought only by a man who has behind him another background than that given by years of academic and government service. The Director's experience, should, moreover, be varied. He should not be a specialized metallurgist, because this will not have given him the desired oversight of the industry. This is the opinion of the present Director—himself a metallurgist. And the Director should not, in our opinion, be a specialized geologist, and for similar reasons, and because of the complementary and adequate nature of the U. S. Geological Survey. He should be a seasoned type of man, for example, like Pope Yeatman, and to instance the type will save us a great deal of further definition.

The office is not remunerative, as we count remuneration nowadays; but neither is the post of Congressman or Senator; and the representative of the mining industry in Washington has more power, with the corresponding influence for good, than a member of either house of Congress. Therefore, our best men should be glad to make the financial sacrifice in order to serve.

Hoover as Secretary of the Interior

THERE is a strong expectation in all parts of the country that if the Republican candidate is elected to the Presidency he will reverse the recent practice and appoint to his Cabinet the strongest and most upstanding men that are available. His own expressed policy is to do this, and beyond question the sentiment of the country demands it. Among the strong men that are included in the provisional slate made up for the Cabinet is Hoover; and he is mentioned as the future Secretary of the Interior.

Anyone who has followed the trend of the master mining engineer's thought as expressed in recent writings and speeches—as in that at the Institute of Mining Engineers banquet at Minneapolis—cannot fail to be struck with his conspicuous fitness for that post. The Department of the Interior is concerned, more than anything else, with engineering problems. Hence the proposal to convert it into a new Department of Public Works, and to gather under it, so far as possible, the various engineering activities which are now sheltered under other departments. Hoover is in favor of this change; but whether or not this proposal materializes, it would be epochal for the Department of the Interior to be presided over by a man who understood the work and the functions of the bureau under his control, and it would be an excellent and sane precedent for all government activities. For the mining industry, of course, it would be a boon greatly to be desired, for the sympathy and understanding of the important mining bureaus in the department, which the Secretary would have, would reinvigorate them, and through their reinvigoration would give new impetus to mining.

The Engineers' Chance

THAT the abilities and capacities of engineers are underrated by the man in the street is still true, though not to the same extent as formerly. For this, we may thank Herbert Hoover and others who have shown the public that we really can do something besides build locomotives, mine ore, plan a sewer, or install a lighting system. Still, however, we know that most people think that a good lawyer or a good doctor is a more desirable citizen than a good engineer. That this is a myth, all of us engineers know full well. *We* know we have a right to cross the street uninjured, but does the chauffeur of the big speeding truck know it?

Things are being done nowadays by organization. The voice of one hundred thousand all saying the same

thing will carry considerably farther than the effort of any individual or small group. At last the opportunity of the engineer is here.

Has the organization to which you belong made application to become a member of the Federated American Engineering Societies? This organization already has an aggregate membership greater than that of any other engineering body in the world. Most of the national societies have already joined or will do so soon. But the local societies and the smaller groups are needed too. Turn to page 633. Write for more information. *You,* personally, bring the subject up at your next meeting. It rests with you, and if you do nothing, blame only yourself for the position of the engineer as a citizen.

Oxygen Breathing Apparatus

THE limitations of the practical utilization of oxygen breathing apparatus have attracted the attention of mining men generally. The necessity for careful examination and thorough upkeep is now universally recognized, and, in most installations of this equipment, testing apparatus is provided and the training of the men in the proper conditioning of the apparatus is not neglected. Given, however, an apparatus in perfect condition, the human factor, or a thorough understanding of its value and method of use on the part of the human being who is to wear it into a dangerous place, is equally vital. The quantity of oxygen is limited. On there being sufficient for the complete round trip proposed depends the life of the wearer.

George S. Rice, of the Bureau of Mines, in a recent publication of the Bureau, calls emphatic attention to the danger of making trips which are beyond the capacity of the apparatus or the physical strength of the wearer. The specific incident that brought about this warning was the death of three men in the Black Diamond coal mine, near Seattle, Wash., recently. These men, equipped with oxygen breathing apparatus, attempted to make a trip 1,200 ft. down a twenty-five-degree slope which was filled with black damp. The supply of oxygen in the tanks was sufficient for only forty-five minutes. Mr. Rice points out that:

To go 1,200 ft. down a twenty-five degree slope, make observations, rest, and then return 1,200 ft., thus making a total distance of at least 2,400 ft. in forty-five minutes, is a quick trip when a man is not encumbered with a heavy load; but to attempt it cumbered by an apparatus weighing about forty pounds makes it more than a hazardous undertaking.

Mr. Rice says, further:

Modern apparatus when fully charged will furnish oxygen for two to two and one-half hours when used with moderate exertion or with periods of rest, but a person uses four to five times as much oxygen in climbing a steep slope with a load of forty pounds as he would when walking at a moderate gait along a level road. It is quite probable, therefore, that the forty-five minute charge indicated by the dial will not last forty-five minutes with the violent exertion necessary. The Bureau of Mines, in its handbook on "Rescue and Recovery Operation in Mines After Fire and Explosions," on page 49, makes the following statement:

"The rescue crews should observe every known precaution for their own safety while traveling in after-damp or other noxious gases. Each crew should be composed of at least five men, including the captain, and the members of the crew should not become separated. If any one member complains of feeling unwell or is observed to be staggering or breathing unnaturally the entire crew should immediately return to fresh air. In view of the liability of a member receiving some injury or his apparatus being damaged a crew should never advance such a distance nor travel over such faults or wrecks as would prevent the crew from carrying one of its members back to fresh air. With the types of breathing apparatus now in service the maximum straightaway unobstructed course should not exceed 5,000 ft. with a reserve crew at the fresh-air base."

While in the foregoing it is to be noted that the maximum distance to be traversed is 5,000 ft., this is for a level, unobstructed road, and, as previously indicated, a trip of 2,400 ft. down a steep incline would be more than equivalent to a 5,000-ft. trip on the level and which maximum distance calls for a fully charged apparatus; that is, with at least three times the amount of oxygen which it was alleged the three men had who made the disastrous trip in the Black Diamond mine. While all of the details of the affair are not known, at least enough has been indicated to send out a caution against men making such a foolhardy attempt, and it is desirable that full facts shall be known, so that the public shall not be prejudiced against an apparatus which has greatest value when it is carefully used and used in accordance with well-established rules.

Bisbee an American Camp

THOSE who have predicted that Bisbee, Ariz., was fated to become a Mexican camp by reason of its proximity to the border, as well as because of the labor situation, will be interested to hear that Grant H. Dowell, manager of the Copper Queen branch of the Phelps Dodge Corporation, recently said that his company would continue to employ English-speaking men underground as far as possible. This has long been the policy of the company, and at present most of its underground employees are American. According to Mr. Dowell, it has been necessary to employ much Mexican labor on the Sacramento Hill project, but this, in Mr. Dowell's opinion, would be only a temporary condition.

American labor has never taken kindly to the idea of a great influx of low-paid Mexican workmen from across the border, and for obvious reasons. It is equally obvious, however, that when American workmen are scarce, a great corporation, on whose continued operation depends the welfare of thousands, will employ such men as it can get, rather than shut down. With the so-called American standard of living in view, the workman in this country has demanded good wages and living conditions, and expects as his right that he be given a square deal in his relations with his employer. All these are to be had in the Bisbee district, where the large operators have gone to much expense to make the community attractive. The companies in this part of the Southwest will seek to keep their camps American, but in this they must be met halfway by labor, organized and unorganized. Only through co-operation can American standards be maintained.

Mining Engineering as a Liberal Education

MANY young men who are not entirely settled as to their future life calling desire to acquire a liberal education to expand their horizon and form a solid foundation for any future activities. Surely this is a wise motive. The question arises as to what education will most fundamentally broaden and develop and inform.

Fifty years ago the answer would have been decidedly "Latin and Greek"—the study of the languages and literature of the Greeks and Romans. The arguments

in favor of this were clever and insistent—in fact, there was no out-arguing the supporters of this, the only "true culture"; yet the notion was only an inherited one, passed down from the Middle Ages, when it held good; and modern progress has dropped it into the background. The daring "new culture" consisted in modern language and literature; in history, philosophy, political economy, and the like. Encroaching on these, again, came the newer claims of science; and last and freshest, the combination of science and engineering. This last is believed by many to afford a broader and sounder culture (as nowadays we must choose) than any of the others. Much that was formerly confined to the university is now outlined in our preparatory schools, so that the developing individual can swiftly record, as in the stages of evolution, the progress of knowledge in outlines of history, Latin, modern languages, mathematics and the like, before the college or university training begins.

If engineering is the soundest foundation of general culture (and the proposition is worth cogitation), mining engineering should be the preferred department, for it covers many special types of engineering—civil, mechanical, geological, electrical, and human. One mine may depend mainly for its success on industrial management, another on mechanical engineering, a third on geological engineering, a fourth on metallurgical engineering, and so on.

Concerning Communism

IN THE Chronicles of the immortal Froissart, among a thousand other interesting pictures, a glimpse of the condition of Ireland toward the end of the fourteenth century is given. The king of England, having finally induced four of the kings of Ireland to signify their allegiance, sent an English squire to instruct them in the refinements of civilization. "When these kings were seated at table, and the first dish was served, they would make their minstrels and principal servants sit beside them, eat from their plates and drink from their cups. They told me this was a praiseworthy custom in their country, *where everything was in common but their bed.*"

We perceive from this that the theory of communism, so incessantly preached in various queer corners even up to the present day, was in practice in Ireland at the period mentioned. The result was what must be inevitable when perfect equality of environment is established—the common standards were those of the lowest, just as the standards of a class at school which must all move forward together will be set by the mentality of the most backward. Froissart relates that the English tutor had difficulty in teaching the Irish kings to wear breeches, and to induce them to ride with saddle and stirrups, which was contrary to their custom.

Indeed, the instinct toward communism is age old, and has been experimented with in countless groups and colonies both here in the United States and elsewhere. The French touched lightly on communism immediately after the revolution, and abandoned it; and it was even tried by the Pilgrims of Plymouth for a brief period after their arrival.

The Eskimos of Alaska, when their country was first explored, were living in communistic villages. The sovereign merit for an Eskimo was giving, not getting; and he who had given away the most was the most honored. An Eskimo would work hard for a year, that he might give a great feast, and distribute his accumulation in presents. Contests were held between neighboring communities or villages in giving, and the side which gave away most to the other was the victor, and the community which had received the most went home humiliated in pride and reputation. Still, the level of the Eskimo in habits and intelligence was as low as the lowest: they were clothed in skins and used the few tools and weapons of the stone age. In the forests of Nicaragua certain groups of Indians live also on the communistic principle; indeed, this seems to have been the general principle of most of the Indian tribes whom the Europeans found in America; and their level of intelligence and manners was such as to merit the common appelation of "savages."

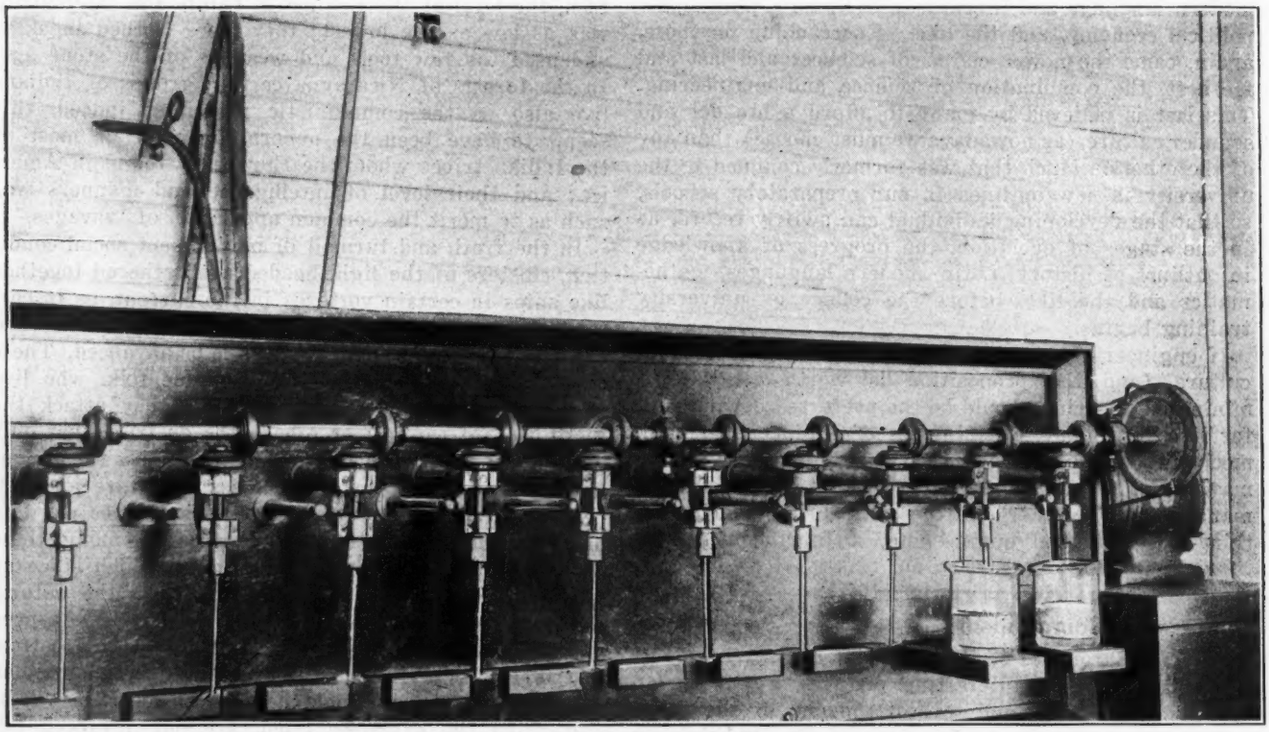
In the froth and turmoil of our present social condition, clusters of the light-headed are gathered together like ships in certain vortexes in the current, as in certain sections of New York, there to indulge in fads and theories which they fondly believe to be advanced. These are strange, vaporous, and unprofitable folk, who live idly on the interest of capital while they attack the institution of capital; or preach the doctrine that only the manual laborer should be fed while they themselves live by soap-box oratory, worthless literature and art, or organizing discontent. Were their theories put into practice, they would starve the first. Among these theories is communism, and bolshevism, which is a step further than communism, since it inverts the natural social fabric, and proclaims that the most advanced and productive shall get least, and those at the bottom of the scale in civilization and mental attainments shall get the lion's share. Such theories, however, it will be seen from the examples cited, are not advanced but ancient, and natural to the savage.

In a different school of thought is the opinion of Darwin, who argued at some length that the life and advance of civilization depend on a leisure class who can pursue the arts and sciences without the handicap of the daily work and worry as to the means of eating, drinking, and sleeping. Huxley was also of the same opinion. Evolution depends upon differentiation, and the permission of the development of irregularity; and this is as true with men as with race- or draft-horses.

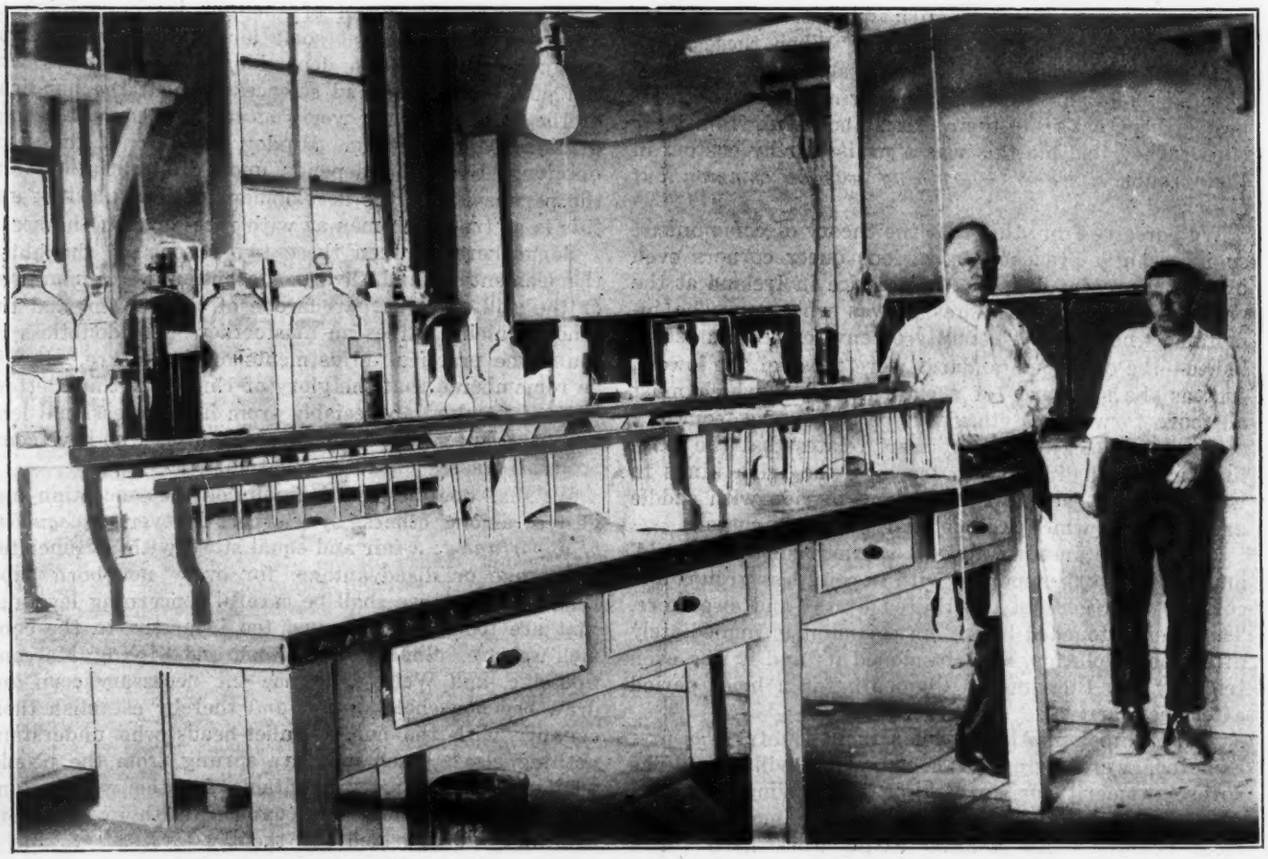
Somewhere between these two schools of thought—the elementary and savage conception of communism, or the still more barbarous one of bolshevism, and the school which justifies an aristocracy—will doubtless be found the practical adjustments of the future. It will be remembered that the glory of English art and letters has not resulted appreciably from her professional leisure class, but rather from those geniuses who have come from all classes of the population.

We shall doubtless settle finally on the conception suggested, among others, by Herbert Hoover, on *equality of opportunity*: a fair and equal start, with no inherited advantage or disadvantage, for every new-born babe. But after that, we shall be careful concerning levelings that are too repressive, and too injurious to the common welfare. Shall Edison, Root, and Kipling, Marconi, Coolidge, and Wells daily hoe the necessary corn and draw the household water; and thereby establish their equality with the honest bullet-heads who understand nothing else? Such men are sprung from the people, who will find it more profitable for the welfare and advancement of the whole commonwealth if their corn and water is provided for them.

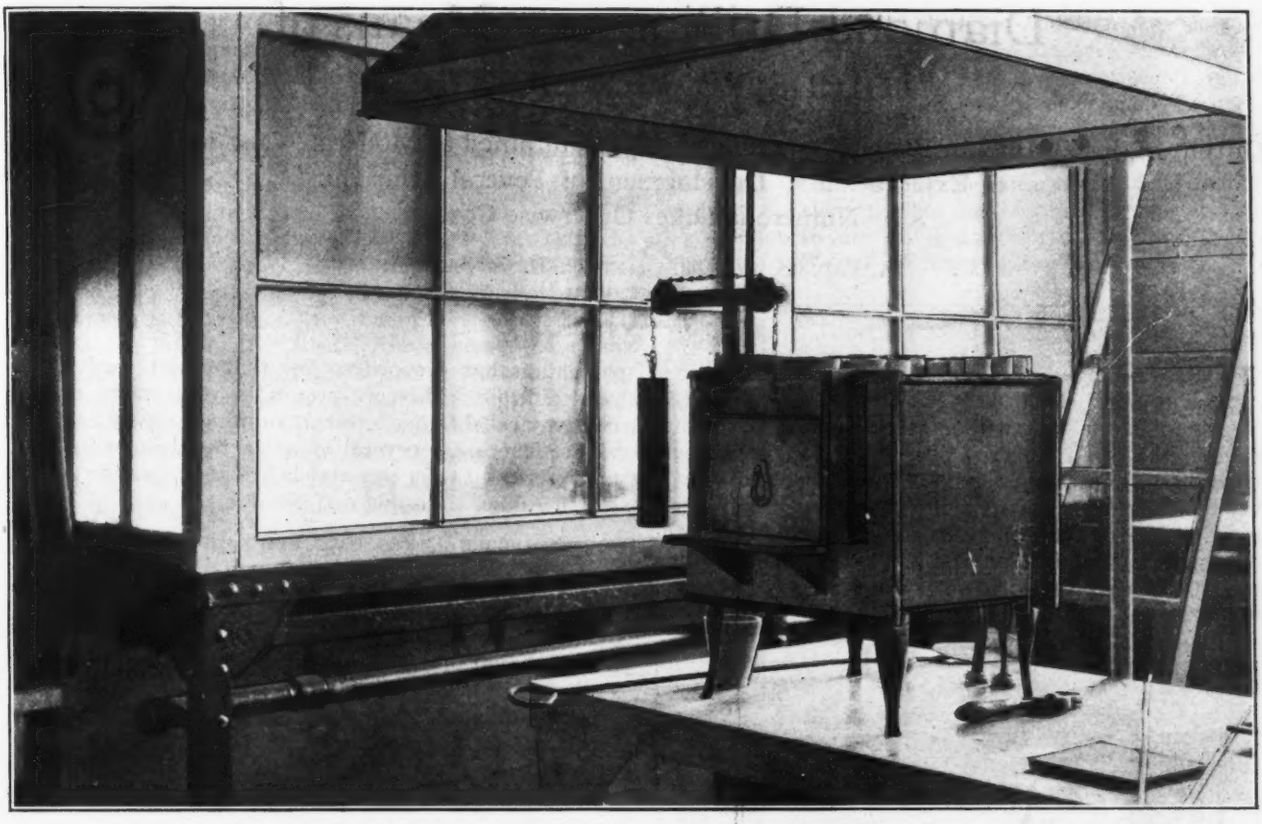
Laboratory Practice in the Southwest



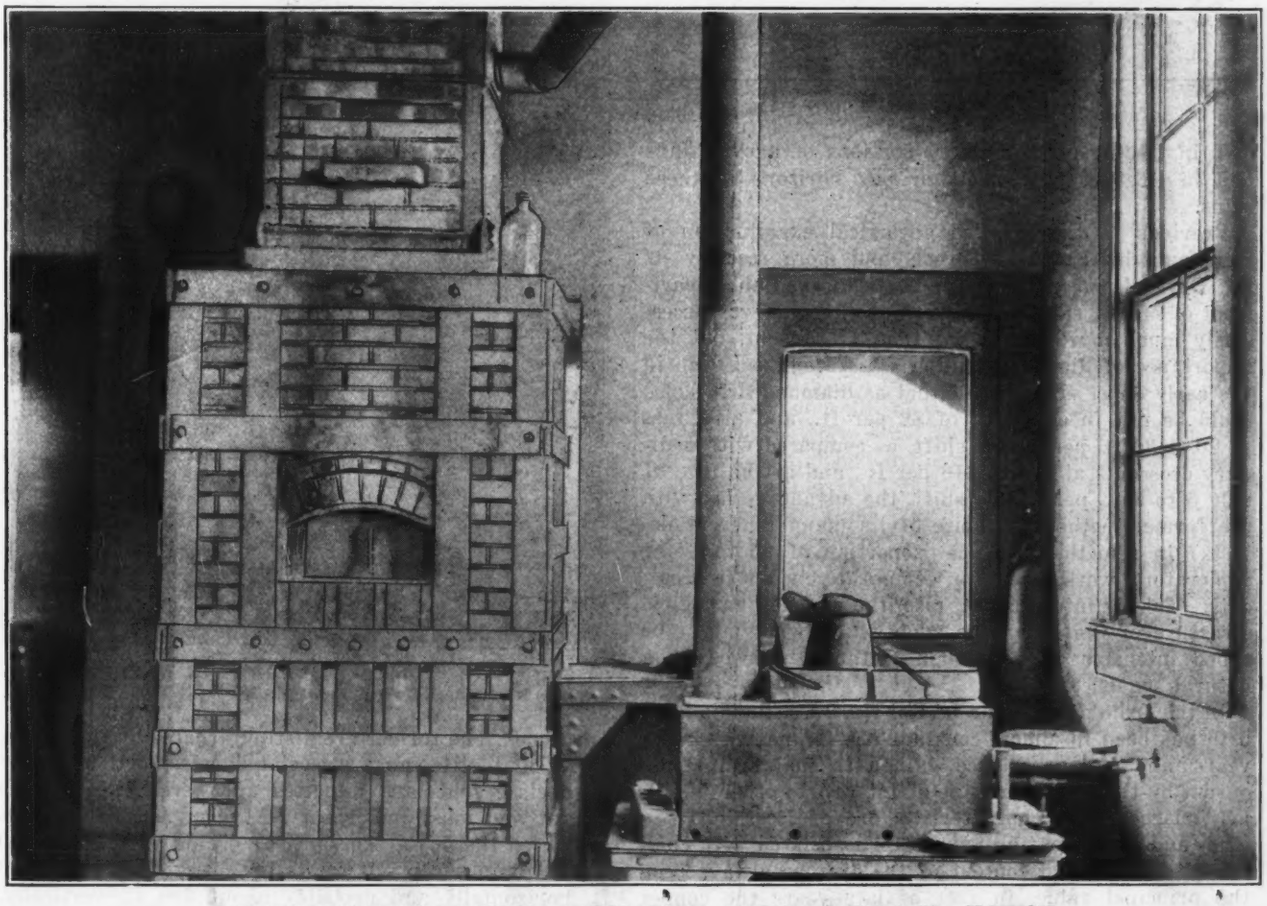
APPARATUS FOR ELECTROLYTIC COPPER DETERMINATIONS



WET DETERMINATION LABORATORY, ARIZONA COPPER CO.'S SMELTER, CLIFTON, ARIZ.



ELECTRIC FURNACE AND HOOD AT THE LABORATORY OF ARIZONA COPPER CO.



ASSAY FURNACES AT SMELTER LABORATORY, ARIZONA COPPER CO., CLIFTON

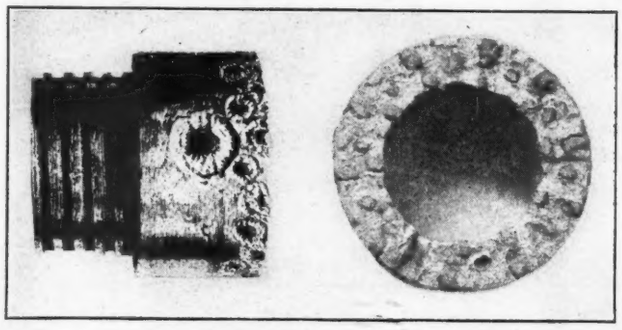
Diamond Drilling as a Means of Intensive Development

Output of Josie Mine, in British Columbia, Long Maintained at Moderate Cost by This Method of Exploration — Development of Several Veins Cut by Numerous Dikes Otherwise Costly

BY PAUL S. COULDREY AND E. H. S. SAMPSON
Rossland, B. C.

Written for *Engineering and Mining Journal*

FEW mining camps owe as much to the diamond drill as Rossland, B. C. It would be no exaggeration to say that without this method of exploration anything in the nature of regular shipments would have been impossible, and it is extremely doubtful whether at present there would be any shipments at all. Continuance of operations has not been due, for the most part, to spectacular discoveries of new large orebodies, though such discoveries have been made, but rather to the continuous every-day use of the diamond drill in tracing out dislocated portions of known veins and in locating pay shoots or pay horizons in these veins.



CHIP BITS IN USE AT ROSSLAND CAMP

Previous to the detailed geological examination of this camp by Professor Brock, and more recently by Dr. Drysdale, at the instance of the Canadian Department of Mines, exploration work of all kinds was necessarily much more haphazard than at present, but the importance of diamond drilling was recognized even in the early days. It was felt that as diamond drill holes could be put in at a cost of $2 per ft., and at a rate of 20 to 30 ft. per double shift, as compared with ordinary crosscuts at $12 to $16 per ft., and at the rate of only 5 to 6 ft. per double shift, the advantage lay with the former method (in spite of its many inherent defects) in something like a proportion of 25 to 1 for exploratory work, even for comparatively short crosscuts. Taking into account, also, the complex geological structure of the camp, the adoption of what might be called intensive diamond drill methods followed as a natural sequence.

In the Josie mine of the Le Roi No. 2 Co. the diamond drill has been in almost constant use for nearly twenty years, and the experience gained in maintaining an output by this means may be of interest to others similarly placed. The characteristic ore of Rossland is a gold- and silver-bearing pyrrhotite associated with chalcopyrite. The gold content of the ore has always been the principal value, in fact of late years the copper percentage has dropped so low that direct smelting is very difficult. This ore occurs in veins more or less nearly parallel to one another, running roughly east and west. There are several veins in the Josie mine, but those referred to in this article are known as the Annie, North Annie, Hamilton and No. 1.

NUMEROUS DIKES CUT VEINS IN JOSIE MINE

The formation in this section of the camp is, for the most part, a very hard augite-porphyrite, with patches of diorite-porphyrite and grano-diorite, giving place at the north end in depth to a silicified stratified rock, and at the south end to a porphyrite-monzonite. Numerous dikes running approximately north and south cut across this formation at frequent intervals, interrupting and in some cases faulting the orebodies. These dikes are roughly divisible into two classes, micaceous and non-micaceous. The former are distinguishable by the prevalence of biotite mica associated with orthoclase or plagioclase feldspar (minettes and kersantites). The largest and most important of the micaceous dikes is known as the Josie (kersantite). This varies from 60 to 100 ft. in width. It faults the ore a distance of 350 ft. horizontally and probably about 200 ft. vertically,

PARALLEL OR "FOLLOWING" DIKES IN HANGING WALL OF STOPE. A—MICACEOUS. B—NON-MICACEOUS

though the amount of vertical throw is not yet clearly established. Mineralized zones frequently occur at planes of contact of the various formations.

The non-micaceous dikes are usually hornblende associated either with orthoclase or plagioclase feldspar, and as a rule are much harder than the micaceous variety. An exception to this rule is the dike locally known as the Porphyry dike (pulaskite), which is traceable from the surface to the 1,300-ft. level, splitting into four or five branches as it goes downward and northward. Accompanying this dike is another one known as the Vitreous dike. Where these two dikes cut across the Annie and North Annie veins the values immediately west of the intersection are invariably poor as compared with those to the east, but with the other veins no such change is noticeable, although an enrichment between the forks of the dike has been observed on the Hamilton vein. The Porphyry dike interrupts all veins without faulting any.

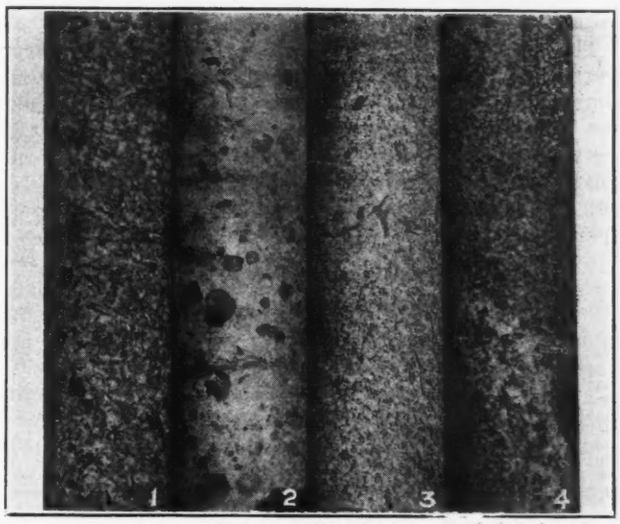
"White" Dike an Underground Landmark

A very interesting dike of the non-micaceous variety, and one which forms a veritable underground landmark, is locally known as the White dike (conglomerate). This has very much the appearance at first sight of a brecciated vein running north and south. It is traceable from the surface to the 900-ft. level, and it is noticeable that large boulders of the same material have been found several miles away. It consists of characteristic angular fragments of white quartz associated with other rocks (such as quartzite, gneiss, and syenite, many of which are entirely foreign to the neighborhood), embedded in a dark olive-green or almost black matrix of spessartite in which large crystals of hornblende are often apparent.

In addition to the north and south dikes proper there are tongues of apparently altered diorite-porphyrite

"WHITE" DIKE, 500 LEVEL, SHOWING SPESSARTITE MATRIX

paralleling certain of the veins. These are usually spoken of as "following dikes," though this may be, geologically speaking, a misnomer. Two such "dikes" (one micaceous and the other non-micaceous) are found interlaced with the ore in the No. 1 vein, and though they are easily distinguishable the result is somewhat confusing, as the ore is found not only under or over but in both positions, and even between them. At the contact of the following dikes with the regular pyritic vein matter exceptionally high values in free gold are sometimes found, usually in the presence of crystals of arsenopyrite, antimonite, and, most noticeable of all, molybdenite. Precisely how this enrichment occurred, and whether of primary or secondary origin, is a matter for conjecture. Good gold values are sometimes found also near north and south mica dikes, for example, under the Tramway dike, in the under or western side of which both the Annie and North Annie veins have "bunched up" and widened out considerably.



DIAMOND-DRILL CORES FROM JOSIE MINE

1. Porphyritic monzonite, showing characteristic crystals of biotite and pyroxene. 2. Augite-porphyrite, showing prisms of augite. 3. Diorite-porphyrite, showing acicular crystals of hornblende. 4. Grano-diorite, showing granular, crystalline structure.

The north and south dikes almost invariably dip at steep angles, sometimes being quite vertical, an exception to this being the "H" dike, which dips flatly to the west, interrupting all veins without faulting, but being itself faulted at certain points. The veins themselves dip in a northerly direction at angles varying from 50 to 80 deg.

Complex Formation Favors Diamond Drilling

Such a complex formation as the above therefore produces at once the opportunity and necessity for rapid exploratory methods. In drifting along any of the above veins a dike will be encountered and crossed. Provided pay ore is not immediately found at the crossing point, diamond drilling can at once be employed to discover either the faulted portion of the same vein, or in the case of a non-faulting dike, to explore for pay ore in the parallel vein. If this is successful the exploratory drifting can be transferred to the second vein, and when this work has advanced sufficiently far ahead a second hole can be put back across the track of the first vein, and *vice versa*. In this way the shortest distance to pay ore can be ascertained, and by inclining the holes upward and downward, and "fanning" them out horizontally, the extent of the shoots can be anticipated within reasonable limits. The majority of the holes drilled in the Josie are horizontal or nearly so, and very little drilling is done in the dikes themselves, as this would be both non-productive and difficult, on account of the broken nature of the ground. The augite-porphyrite, on the other hand, though hard, gives excellent cores.

For the flat holes an "E" Sullivan drill equipped with a Stone core barrel is used, the outside diameter of the bit being 1 7/16 in. and the diameter of the core 7/8 in. This machine is not recommended by the makers for depths of more than 450 ft., but here it has drilled five holes over 1,000 ft. and at least a score over 600 ft.

For down holes an "S" Sullivan drill, also with a Stone core barrel, is used, the same sized hole being drilled as with the "E" machine. In both flat and down holes chip bits are used extensively, more particularly for short holes. These chip bits, however, are not suitable for broken ground.

The advantages of the above system of exploratory work would not be nearly so apparent in mines with a simple vein structure, but some such system, modified, for "spotty" mines having parallel veins might be well worth considering, provided, first, that the geological conditions are known, and, second, that the ground is not too soft or broken for rapid and cheap drilling operations.

COST OF DIAMOND DRILLING AT JOSIE MINE

Year	Feet Drilled	Total Cost per Ft. (Labor, Air and Supplies)	Year	Feet Drilled	Total Cost per Ft. (Labor, Air and Supplies)
1902	2,148	$2.37	1911	14,932	$1.65
1903	3,748	2.64	1912	14,185	1.69
1904	3,617	2.22	1913	15,075	1.60
1905	3,121	2.70	1914	12,249	1.63
1906	4,505	1.86	1915	2,799	1.72
1907	5,088	2.61	1916	5,065	2.23
1908	7,439	2.39	1917	897	1.84
1909	9,820	1.96	1918	3,995	1.65
1910	11,508	1.89	1919	3,535	2.04

The total footage is 120,762 and the average cost per foot $1.92 over a period of eighteen years. Of the above footage, 4,831 ft., or 4 per cent of the total, were down holes. The proportion of diamond drilling done to ordinary development is about 2 to 1. In 1904, a double-tube return water (Stone) core barrel was first used. During the last five years covered by the above table detailed costs per foot have been as follows: Labor, $0.99, being 51 per cent of the total; air, $0.28, being 14 per cent of the total; and supplies, $0.68, being 35 per cent of the total, which is $1.95.

The total cost will now probably be higher, on account of increased labor costs. All of the above work was done on day's pay.

Mineral Production of Former German Southwest Africa

The mineral output of Southern Africa, in 1913, according to *The Ironmonger*, was valued at £3,517,351. Of this sum, however, no less than £3,084,581 represented the value of the output of diamonds. The balance of £432,770 was made up mainly of copper ore and matte (including also lead ore) to the value of £396,436, tin ore to the value of £31,568, and other ores and minerals with an aggregate value of £3,316. Copper ranks second to diamonds in importance among the minerals of the Protectorate, the principal concern engaged in the copper-mining industry being the Otavi Mining & Railways Co., which was registered in Germany in 1888, with a capital of £200,000, in 200,000 shares of £1 each, all issued and fully paid up. Copper mining is conducted by this company at Tsumeb, Guchab, Great Otavi, Asis, and in the Otavi Valley, the principal mine being at Tsumeb.

Particulars of the total mineral output for the year 1918 are not available, but the Otavi Co. exported 7,358 tons of ore, with an assay value of 12 to 33 per cent of copper and 12 to 22 per cent of lead. On Dec. 31, 1917, the company had on hand 139,322 tons of ore, with an assay value of 2 to 41 per cent of copper. The Otavi Exploring Syndicate for the year 1918 reported exports of 100 tons of ore, with an assay value of 43.5 per cent of copper.

The export of tin from the Protectorate began in 1911 with consignments of nine tons, valued at £470. By 1913 the exports had risen to 200 tons, valued at £34,500. Ninety per cent of the best tin claims have now been acquired by British companies. German prospectors were first in the field, but they appear to have found no support, either locally or in Germany. A considerable number of the claims in British hands appear to be payable, but the distribution of the ore is for the most part over the surface, with little depth. The development has, on the whole, been slow, and the companies will not erect their final plants until they have proved the capacity of their claims to their satisfaction. The output of tin in 1918 amounted to 65 tons, assaying on the average at 68 per cent. The quantity on hand at the end of the year, however, amounted to only 33 tons.

The following figures, however, relating to the chief exports of minerals for the years 1913 and 1918, and for the nine months ended Sept. 30, 1919, serve to indicate some of the recent effects of the war upon the export trade:

	Exports		
	1913	1918	Jan.-Sept. 30 1919
	£	£	£
Diamonds	2,945,475	652,628	395,955
Copper	10,002	.....	.....
Copper ore	381,434	55,981	5,278
Tin	34,500	12,800	5,256
Lead	17,293	.....	.....
Other ores	2,958	.....	.....

Activities of Ontario's Nickel-Copper Refineries

During the half year Jan. 1-July 1, 1920, a total of 627,681 tons of ore was raised, and 520,705 tons smelted in Ontario, the total output of nickel-copper matte being 28,365 tons, containing 15,480 tons of nickel and 7,705 tons of copper, according to the Ontario Department of Mines. The British America Nickel Corporation and the International Nickel Co. of Canada worked the Murray and Creighton mines respectively, and the Mond Nickel Co. raised ore from the Garson, Levack, Bruce, Worthington, and Victoria No. 1.

As regards shipments of matte, 7,944 tons went to Canadian refineries at Port Colborne, Ont., and Deschenes, Que.; 16,323 tons to the United States; and 1,123 tons to Wales. During the period the new electrolytic refinery at Deschenes began operations and had 1,185 tons of matte in process on June 30, although no refined metals were ready for market at that date. The new plant, which permits recovery of metals of the platinum group in pure form, is reported to be working satisfactorily, as is also the smelter at Nickelton, one mile from the Murray mine, where the ore is smelted direct without preliminary roasting. In addition to metallic nickel, nickel oxide and blister copper, there was a byproduct recovery at Port Colborne of the precious metals, gold, silver, platinum, palladium, rhodium, ruthenium, osmium, and iridium. There was also a small recovery of copper in the United States from Ontario silver ores.

Gold Mining in British Guiana

Gold Production Has Been Decreasing Since 1895 and Is Now Only About One-Eighth the Maximum Recorded—A Few Companies Are Still Operating, but Mining Is Hampered by Lack of Transportation and High Costs

Written for *Engineering and Mining Journal*

IN 1595 Sir Walter Raleigh touched the coast of the Guianas and ascended several rivers in his search for El Dorado the mythical city, whose houses were supposed to be roofed with gold. The publication by him of "The Discovery of Guiana," with its descriptions of enormous serpents, one-legged men, and other freaks of nature, undoubtedly led other adventurous spirits to visit the region. Permanent colonization followed, with the usual changes of control from Spanish, French, and Dutch to English which was so common in the days of buccaneers in the West Indies.

LOW RIVER STAGE. HAULING A BOAT UP A SMALL RAPID

The first recorded instance of an organized search for gold was an expedition in 1720, which ascended the Berbice River. In 1740 the directors of the Dutch West India Co. sent an expedition under an engineer named Hildebrand to explore the Mazaruni, Cuyuni, and Essequibo rivers. These first attempts were failures, and it was not until 1863 that a well organized effort was made to find gold in paying quantities, when a company was formed consisting of local and English capitalists called the British Guiana Gold Co. Gold-bearing quartz was found at Wariri, on the Cuyuni River and work was started, including the erecting of a small stamp mill. The project was, however, abandoned, owing to a boundary dispute between Venezuela and British Guiana, which arose over the territory in question. In the early eighties, interest was again aroused in the possibilities of successful gold mining, and in 1884 a production of 250 oz. is recorded.

PICKING THE WAY BETWEEN SUBMERGED ROCKS

Until 1890 only placer mining was carried on. The Omai placers, on the Essequibo River were one of the most successful operations, about 24,000 oz. of gold, being obtained from claims in the first two and one-quarter years of work. In 1890 the numerous outcrops of auriferous quartz reefs in the gold-bearing areas began to excite interest. Engineers and gold miners from other parts of the world were attracted to British Guiana, and an era of promotion started. Numerous companies were organized, and several large mills for crushing quartz were erected. The most notable among these operations were Kanaimapoo, on the Demerara River; Arakaka on the Barima River; Peter's mine, on the Puruni River (fifteen-stamp mill), and Aremu, on the Cuyuni. None of these mills are now operating. The total amount of gold produced by milling to date is 69,430 oz. The yearly production of gold since 1884 is given in the following table, which is taken from the annual reports of the Department of Lands and Mines:

THE LANDING PLACE AT ROCKSTONE, FROM WHICH THE START TO THE GOLD FIELDS AT THE ESSEQUIBO RIVER IS MADE

Year	Ounces	Year	Ounces
1884	250	1904–1905	95,864
1885	939	1905–1906	94,363
1886	6,518	1906–1907	85,504
1887	10,986	1907–1908	67,209
1888–1889	20,216	1908–1909	73,654
1889–1890	32,332	1909–1910	64,829
1890–1891	66,864	1910–1911	54,988
1891–1892	110,555	1911–1912	50,273
1892–1893	134,124	1912–1913	51,765
1893–1894	138,527	1913–1914	82,706
1894–1895	132,994	1914–1915	64,982
1895–1896	121,285	1915 Apr. to Dec.	39,793
1896–1897	127,479	1916	37,129
1897–1898	121,490	1917	29,538
1898–1899	113,114	1918	24,546
1899–1900	112,789	1919	16,216
1900–1901	114,102	1920, Jan. to Mar. 31	2,315
1901–1902	101,332		
1902–1903	104,526	Total	2,596,448
1903–1904	90,336		

It will be noted that the peak of production was reached in the year 1893-94 with an output of 138,527 oz., but that the industry has steadily declined, with little reaction, and lately, in common with gold mining all over the world. Production for 1919 was only about one-ninth of what it was in 1893. The gold mined in 1919 came from the following districts:

	Ounces
Barima River	1,321
Barima River	118
Cuyuni River	394
Puruni River	564
Mazaruni River	5,982
Potaro River	7,714
Essequibo River	71
Wani River	48
Total	16,216

HYDRAULIC MINING IN BRITISH GUIANA

The value of the 1919 production was $287,044.

The production to Dec. 31, 1918, was distributed according to sources as follows:

	Ounces
Quartz milling	69,430
Dredging	107,622
Hydraulic operations	38,367
Placer, by hand mining	2,362,498
Total	2,577,917

The following large nuggets have been found in the districts given:

	Ounces
Jumbo, Barima River, one weighing	333
Kanawaruk Creek, Potaro River, one weighing	274
Tiger Creek, Potaro River, one weighing	106
Puruni River, one weighing	90
Omai Placers, Essequibo River, one weighing	84

At present, two companies, the Guiana Gold Co., Ltd., and the Minnehaha Developing Co., Ltd., have six small dredges on creeks running into the Essequibo and Potaro rivers. These companies have been much hampered for the last few years by the increase in the cost of provisions and labor and the difficulty in getting supplies and renewals; so much so, that the government saw fit to remove the royalty of 70c. per oz. on Jan. 1, 1919, and charge, instead, a tax of 5 per cent on the profits.

The last hydraulicking outfit, that of the Tassawini Mining Co., on the Barima River, shut down in 1914 after reporting a production of 243 oz. for that year. Quartz milling in the colony stopped with the closing down of the Peter's mine in 1916.

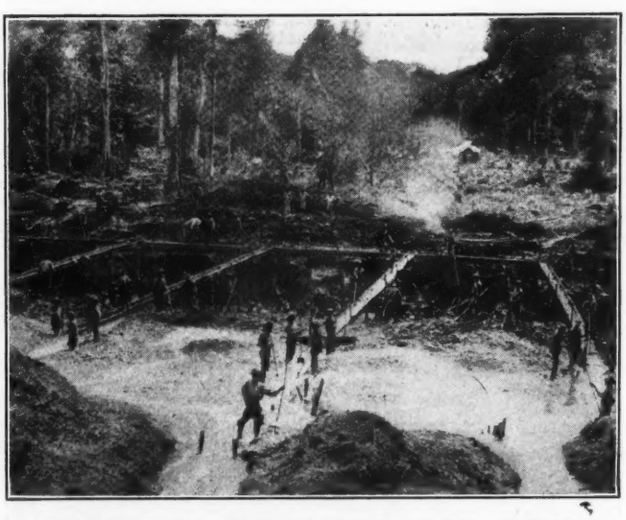
By far the largest part of the production has been from small placer operations. In the balmy days of the industry, large, well-organized parties carried on the work. At present, however, most of the gold comes from what are known as "pork-knockers." These are negro or colored men, who are grubstaked by claim owners or shop-keepers, and who go up to the "bush" for six or eight months on a trip, dividing the profits on their return. They band together for mutual protection and help in getting boats up the rapids. Several Chinese firms maintain shops or trading posts in the interior, but the supplies from them are uncertain and expensive.

Practically all of the interior is still crown land. A prospecting license, costing $5 per year, allows a prospector to operate anywhere on government land not already leased in locating a claim. Claims measuring 1,500 ft. x 800 ft. for gold and 500 acres for diamonds pay an annual rental of $5 each, plus a royalty of 50c. per oz. on gold and a royalty of about 10 per cent on diamonds.

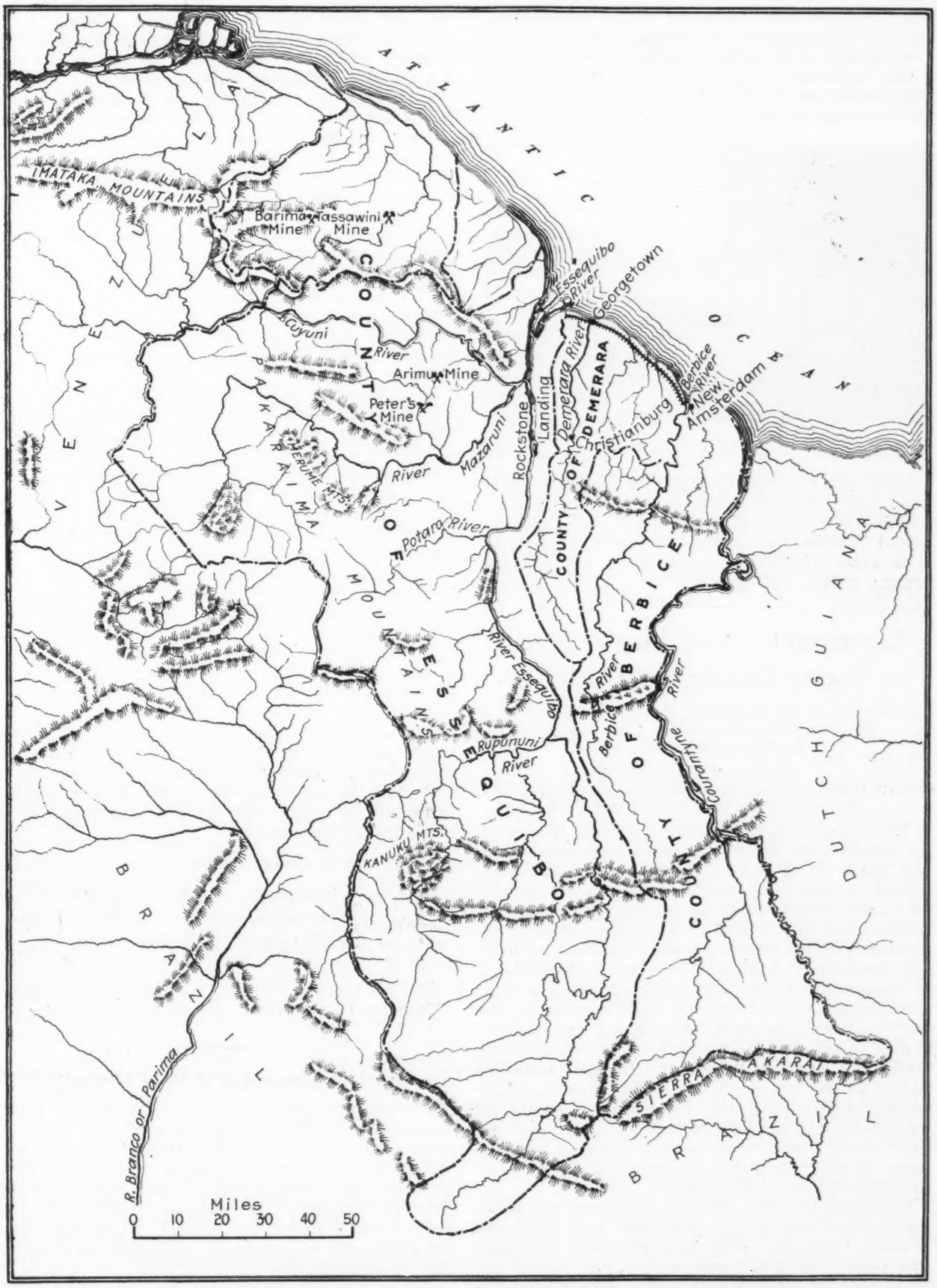
Mining concessions or leases for ninety-nine years can be obtained on any area by payment of $10 on application, and an annual rental of 20c. per acre. Dredging concessions on rivers or creeks pay 10c. per acre.

The decline of the gold-mining industry does not seem to be due to the working out of the field, as large areas are scarcely touched, but to the high cost of provisions compared to the more or less fixed price of gold and the diversion of the labor to the bauxite fields and the sugar plantations.

Prospecting is difficult, owing to lack of transportation and the denseness of the tropical jungle. Trails when cut are quickly overgrown and disappear in a few weeks. No railroads have been built into the interior, and the only two roads that have been cut have never been kept in condition to be of use, so the only method of getting into the interior is up the rivers. As soon as one leaves the alluvial belt along the coast the rivers are a series of rapids and low cataracts. Dragging boats up these is slow and laborious work. When the rivers are in flood they overflow into the jungle, and there is no shore on which to land or from which to work. In the dry season the reverse is true—a small volume of water is spread out in trickles over a large area and boats have to be dragged over sand and between boulders. The change from one condition to another is often quite rapid and a boat starting down with a flood may



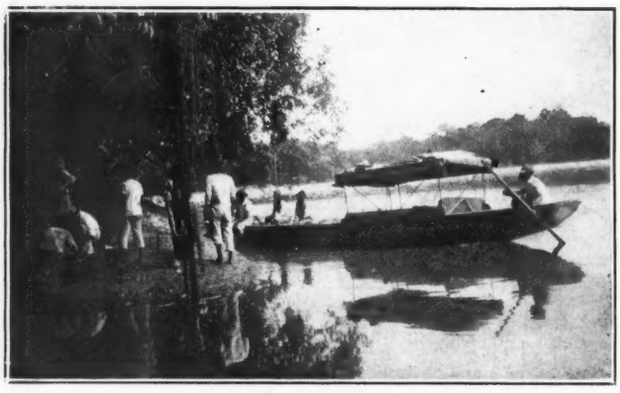
WASHING FOR GOLD IN TIGER CREEK, POTARO



A MAP OF BRITISH GUIANA, SHOWING PRINCIPAL TOPOGRAPHICAL FEATURES

ground before reaching tidewater. The failure of the large companies seems to be due to poor organization, expensive transportation, and tropical diseases.

In a number of instances, companies that have tried to take machinery to the interior have expended their entire capital on transportation, and at several plant sites equipment is now rusting in the original crates.



LUNCH TIME ON AN ISLAND

It would seem that the transportation problem could be solved only with government aid.

With modern knowledge of tropical sanitation developed in Cuba, Panama, and elsewhere, there should be no great difficulty in combating the two principal diseases, malaria and dysentery.

Comparison of High- and Low-Grade Cyanide

Equally Good Metallurgical Results Follow Use of Product Containing 37 Per Cent NaCN By Tonopah Extension

BY JOHN G. KIRCHEN
General Manager, Tonopah Extension Mining Co., Tonopah, Nev.
Written for *Engineering and Mining Journal*

UNTIL recently, the Tonopah Extension Mining Co. has used the ordinary cyanide, containing 97 per cent NaCN, in its mill at Tonopah, Nev. Calculation showed, however, that the low-grade cyanide now on the market could be delivered at a less cost per unit of NaCN, so it was decided to make some experiments to determinate the relative efficiency of the two products.

In preliminary laboratory tests, equal quantities of the same grade of silver-gold sulphide ore were agitated under parallel conditions with solutions of the same cyanide content, one using "Aero Brand" cyanide containing 37 per cent NaCN and the other solution using the 97 per cent NaCN product. One-half pound of lead oxide per ton of ore was added in each test to precipitate the sulphide ion liberated in the solution by the dissolving of the silver with NaCN. The gold and silver extractions after 60 hours of agitation were the same—93 per cent—and the consumption of NaCN and CaO was the same in both tests.

In a following test, the lead oxide was not added. Again, the extractions in both tests were the same, although 1 per cent lower than when the lead oxide was added; the NaCN consumption was higher but practically the same in both tests. After some additional work, which confirmed these results, it was decided to use the low-grade cyanide in the mill.

For the last seven months "Aero Brand" cyanide has been used exclusively. It has proved satisfactory as a dissolving agent for silver and gold contained in the company's sulphide ore and "reducing" matter has apparently not accumulated in the solution.

An analysis of this product, as furnished by the manufacturers, shows: CN, 19.10 per cent; Cl, 25.13 per cent; Ca, 28.13 per cent; Na, 16.40 per cent; SiO_2, 0.80 per cent; R_2O_3, 0.91 per cent; Graphitic C, 3.94 per cent; Carbide C, 0.36 per cent; S, 0.55 per cent; N (?), 1.14 per cent; Mg, 0.15 per cent; O & Undet., 2.80 per cent.

This cyanide is shipped in cylindrical steel drums weighing 380 lb. gross and containing about 360 lb. of cyanide product, which contains about 37 per cent NaCN. The material is in the form of small, brittle flakes of dark gray color, about $\frac{1}{32}$ of an inch thick and from $\frac{1}{4}$- to $\frac{1}{2}$-in. in diameter. The soluble portion dissolves readily, leaving a light, flocculent, black residue.

In mill practice solution is effected in a tank in which a mechanical agitator is installed. Agitation promotes the more rapid dissolving of the soluble constituents. On account of the CaC_2 present, acetylene gas is immediately generated, so it is advisable that good ventilation be maintained over the dissolving tank. Ammonia is also frequently liberated from the solution. The small amount of soluble sulphide present apparently oxidizes rapidly. The alkalinity (not including that of the NaCN) is about 12 per cent, in terms of NaOH, so it is of service in neutralizing acidity and consequently saves lime, where lime is used to promote alkalinity of the solution.

The following table gives a comparison of results covering one month's operation at the mill of the Tonopah Extension Mining Co., using 97 per cent NaCN exclusively; also one month's run at the mill, using the 37 per cent NaCN "Aero Brand" cyanide. The two months selected were July, 1919, and March, 1920, and were taken for comparison because the average silver content of the ore treated during each of these months was about the same. The solutions used were also of the same NaCN content.

COMPARISON OF RESULTS WITH HIGH- AND LOW-GRADE CYANIDE

Cyanide Content of Product, per Cent	Feed Assay, Oz.	Tailing Assay, Oz.	Per Cent Extraction	Consumption NaCN per ton, Lb.	Consumption NaCN per Oz. Bullion, Lb.
97	11.63	0.90	92.26	1.64	0.142
37	11.34	0.82	92.77	1.71	0.160

The "reducer" in solution, in terms of N/10 $KMnO_4$ (Clennel test), was 4.2 cc. and 4.0 cc. respectively.

Ancient Rumanian Copper Deposits

The iron and copper deposits of the Oltenic region, Rumania, were known to the Romans, and traces of their workings are still found. Owing to the low percentage (2 to 4 per cent) of copper which the ore gave, the experiments recently made to re-establish the working of these deposits have ceased, according to *Commerce Reports;* but pyrites rich in sulphur (40 per cent) were being extracted as a means of continuing the manufacture of sulphuric acid.

Copper ore (5 to 7 per cent) has been found in the Dobrudja. In this area deposits of ore amounting to 250,000 tons are estimated.

Calculation of Unit Smelting Costs and Values

Effect of Sulphur—How and Why a Tariff Should Be Made Up for the Mine Superintendent — Lowering Cost by the Substitution of Different Ores and Fluxes—Fixed vs. Operating Expenses and Their Effect

BY C. A. GRABILL.*
Written for *Engineering and Mining Journal*

SLAG composition has been discussed in a previous article, but so far nothing has been said about what consideration should be given to sulphur in calculating a furnace charge and product. The question is by no means simple. In the first place, sulphur has three different effects causing a variation in its value. They are: fuel value, reducing value, and matting value, though the first two may be considered as one. This combined value for the first two properties may be considered separately from the third without interfering with the conclusions reached. It is difficult to give any formula representing the combined value, because it is dependent on many factors, but the subject may be considered in this way:

A good black-copper charge would smelt with 17 per cent of coke and 1 per cent of sulphur. With each added unit of sulphur, one unit of coke could be deducted until 10 per cent of sulphur is reached. From that point the value of the sulphur as fuel would decline rapidly until the sulphur becomes a source of expense. The reducing value is a part of the above effect, and I think most of the ferric oxide is reduced by sulphur. These interchanges represent merely a certain balance attained in actual practice. A change in the quality of the coke or its cost would alter the relative amounts involved.

The matting value and the fuel value are both recorded in the statistics covering the smelting cost. That is, if conditions are such that it pays to run with the lowest possible fuel, the amount of coke in the table of smelting costs will decrease, and at the same time and in proportion, the figure representing the recovery of sulphur in the matte will decrease.

MATTING VALUE INDETERMINATE

From an absolute standpoint, the matting value is indeterminate. Take a low-grade oxidized copper ore as an example. The first unit of sulphur is absolutely necessary to the smelting operation; the second not quite so important, and so on, in constantly decreasing value, until sulphur becomes an annoyance and source of expense.

The subject is complicated by the fact that the sulphur atom is bound to an iron atom with a fluxing value, but causing a copper loss in the slag. In any given operation, however, this is determinable, but it is necessary to avoid misconceptions.

Take the instance considered in the last article[1] with the sulphur in ore *B* as shown. It is clear that if the ore *D* can be purchased at a price at which the cost of a unit of Fe would be the same as that in the ore *B*, still, operations could not be maintained with *D* in place of *B*. The sulphur is the cause of the difference and must therefore have some definite value.

Now, 28 per cent CaO in the slag has been assumed as the most favorable amount; it will be assumed further that for the furnace operation it is immaterial whether the lime varies a few per cent or not, the injurious effect on the losses being protected by the charge against the iron. This being so, the fluxing value of the iron is limited by its equivalence to CaO, and is less than the value of CaO by the amount of copper loss caused by the equivalent of Fe.

What would happen if the lime limit were 28 per cent, making it necessary, in case of increased silica, to purchase sufficient iron to hold the CaO down to this amount is another matter, and does not enter at this point. It may be said, however, that the relative values would have to be determined for both iron and sulphur from the savings or losses incurred by unit changes in the charge.

Applying the reasoning stated above, and taking the data from Table I[2], the following quantities are obtained:

Cost of 1 ton of limestone	$2.00	
Cost of smelting 1 ton and fluxing coke ash	4.12	
2 units of SiO_2 require 1.185 units of base each, and 54 units CaO less 2.37 units leaves 51.63 units available, costing	$6.12	
	$6.12	
1 unit CaO costs	11.84c.	
1 unit of SiO_2 requires 1.185 unit CaO at 11.84c. =	14.04c.	
1 unit Fe = 9/7 unit FeO, and, therefore, of CaO, and is worth for fluxing, not allowing for the effect on slag loss	15.21c.	
1 unit of copper in matte requires sulphur in the charge for matting purposes	4.665	units

With this data the cost of the sulphur in the sulphide flux may be calculated.

COST OF SULPHUR

Cost of 1 ton of sulphide flux	$9.00	
Smelting and ash of coke	4.12	
4 units of SiO_2 at 14.04c	.56	
Cu loss: 48 units Fe at 0.3135 lb. = 15.05 lb	3.01	
Credit 20 lb. Cu at 20c		$4.00
Credit 95 per cent of 1 oz. Ag		1.19
Credit 48 units Fe @ 15.21c		7.31
Fe for 4.95 lb. Cu in matte	.04	
Credit for overcharge of Cu loss		.01
	$16.73	$12.51
	12.51	
44 units S, less 1.15 for matte for Cu recovered	$4.22	
Cost of 1 unit of sulphur	9.85c.	

The price of 15.21c. per unit for Fe denotes its equivalence to CaO in fluxing value, and to get its real value the copper carried into the slag by it must be deducted. Thus, 0.3135 lb. Cu at 20c. is 6.27c. Deducting this from 15.21c. leaves 8.94c., and correcting for iron and sulphur not carried into the matte, makes the cost of Fe 9.81c. per unit.

Much calculating may be saved by determining the value of the iron and sulphur in the matte per pound of copper and deducting the result from the works value, and also using the above cost as given for the iron contents.

4.665 lb. S per lb. Cu = 0.23325 unit S =	2.30c.
0.95 lb Fe @ 9.81 =	.46
Total deduction per lb. Cu	2.76c.

*Last of a series of three articles on the calculation of blast-furnace charges and costs. The first article was published Sept. 11, and the second Sept. 18, 1920.

[1]See our issue of Sept. 18, 1920, page 371.

[2]See our issue of Sept. 18, 1920, page 569.

Returning to the original ore

Smelting, etc.	$4.12	
50 units SiO_2 at 14.04c. per unit	7.02	
10 units Fe at 9.81c. per unit		$0.98
18 units CaO at 11.84c. per unit		2.13
1 unit of sulphur at 9.85c. per unit		.10
2.76c. deduction on 60 lb. Cu (not otherwise charged)	1.66	
	$12.80	$3.21
	3.21	
Cost of smelting one ton of *A* ore	$9.59	

The tools being obtained and tested it is possible to use them not only on the regular ores but also on others. Consider *D* ore:

SiO_2, 4 units at 14.04c. per unit	$0.56	
Smelting and ash	4.12	
Credit 65 units Fe at 9.81c. per unit		$6.37
	$4.68	$6.37
		4.68
Value of 1 ton		$1.69

Form for a Smelter Tariff

The metallurgist is now in position to make up a tariff for the mine superintendent:

Silver—Pay 95 per cent.
Copper—Market price less 5.26c. (2.5 marketing expenses plus 2.76).
Iron—Pay 9.81c. per unit.
Lime—Pay 11.84c. per unit.
Sulphur—Pay 9.85c. per unit.
Silica—Deduct 14.04c. per unit.
Treatment—$4.12 per ton.

All taxes and duties of whatever nature in force at the time of, or within sixty days subsequent to the receipt of the ore, and levied by Federal, state, or municipal government or other authority on the ore, substances contained therein or products thereof, whether levied on the production, extraction treatment, shipment, or sale, or on the documents covering these transactions, are for the account of the shipper.

This tariff may be suspended on due notice, or without notice, in case of force majeure.

conditions constant, such as percentage of coke on the charge, and sulphur recovery, the calculations are shown in Table III. It can, of course, be said that the higher silica slag would increase the requirement for coke, but my own experience leads to the belief that the demand for more heat is met largely by the increased percentage of sulphur oxidized on the charge, and that the practical effect is slower furnace running. That always tempts one to the use of more coke to speed up the smelting.

Taking the data from Table III, the cost of smelting a ton of ore would be:

Smelting 620 lb. ore at $4.00	$1.24
180 lb. sulphide flux	.34
Smelting 180 lb.	.36
Copper loss: 1.71 lb. at 20c.	.34
Total for 620 lb.	$2.28
Total for 1 ton of ore	7.36
Saving on silver in the slag	.20
Net cost	$7.16

The saving over the other method in this operation would amount to $2.33 per ton of ore, which would seem to offer ample opportunity to pay interest on an extra furnace, or the cost of a little extra coke or compensation for considerable furnace trouble.

In the case mentioned, the extra furnace capacity was available and the effect of the higher silica showed in slower running and a little extra furnace trouble. The conditions demanding the higher silica lasted only a few weeks, and the practice was discontinued.

The difference in the character of the slag is to be noted. In the former case the lime almost reached the upper limit, whereas in the latter it is about the average and the Fe has increased but slightly. The copper lost per unit of Fe has decreased, as is forecast by the curve in Fig. 8.[4]

TABLE III. CALCULATION OF CHARGE

Material	Amount, Lb.	Ag Assay	Ag Oz.	Cu %	Cu Lb.	SiO_2 %	SiO_2 Lb.	Fe %	Fe Lb.	CaO %	CaO Lb.	Al_2O_3 %	Al_2O_3 Lb.	S %	S Lb.
A	620	20.0	6.20	3.0	18.6	50.0	310.0	10.0	62.0	18.0	111.6	4.0	24.8	1.0	6.2
B	180	1.0	0.09	1.0	1.8	4.0	7.2	48.0	86.4	....	....	....	....	44.0	79.2
Coke	(80)	....	....	....	....	10.0	8.0	3.0	2.4	0.4	0.3	5.0	4.0	....	....
Total	800	....	6.29	....	20.4	....	325.2	....	150.8	....	111.9	....	28.8	....	85.4
Slag	664	0.82	0.27	0.257	1.71	....	....	....	....	....	....	....	....	....	....

$85.4 \times 0.15 \div 0.25 = 51.24$ = Wt. of Matte
$20.4 - 1.71 = 18.69$ = Wt. of Cu in Matte
$18.69 \div 51.24 = 36.5$ = % of Cu in Matte
$51.24 \times 0.34 = 17.4$ = Wt. of Fe in Matte
$150.8 - 17.4 = 133.4$ = Wt. of Fe in Slag
$133.4 \times 1.287 = 171.5$ = FeO equivalent

Slag Content:	Lb.	%
SiO_2	325.2	49.1
FeO	171.5	25.8
CaO	111.9	16.8
Al_2O_3	28.8	4.3
Miscellaneous	26.6	4.0
Total	664.0	100.0

Slag: Base $\div$ SiO_2 = 0.872

Silver:	
Matte assay, oz.	235
Slag loss, per cent	4.3
Copper:	
Matte assay, per cent	36.5
Slag loss, per cent	8.38
Slag loss, lb. per ton of charge	4.275
Slag loss, lb. per unit of Fe in slag,	0.2563
Slag loss, lb. per lb. of Fe in slag,	0.01281

N. B.—Slag assay calculated from Fig. 6 and corrected for miscellaneous constituents to correspond with Fig. 2 and Table I, by deducting 0.035 from amount in Fig. 6.

Returning to the last article[3], the question naturally arises as to whether the assumed slag is the best possible one to use under the circumstances. The answer depends largely on local conditions; off-hand, I should say not. I think that in this case the silica should be increased to at least 45 per cent, though in one instance under nearly the same circumstances I was not able to run a slag containing more than 40 per cent silica, because of conditions not considered in this calculation. On the other hand, I once successfully used a slag containing over 49 per cent SiO_2, having very much the same analysis as will result in this case, by dropping the limestone from the charge. Keeping all the other

With iron and lime contents of the slag both in the middle of their range, it is proper, on the assumptions so far made, to consider the cost of fluxing a ton of silica as if the fluxing could be done with limestone alone; in this example it would cost 10.21c. per unit, because any moderate variation in the iron-lime ratio is taken up in the constants used.

If, however, the case as shown by Table I and the schedule offered to the mine is considered, and it is assumed that practical considerations limit the slag to 42 per cent SiO_2 and 28 per cent CaO, the situation is one of unstable equilibrium. Suppose ore *E* is offered. In this example it cannot be assumed that it can be

[3]See our issue of Sept. 18, 1920.

[4]See our issue of Sept. 18, 1920, page 571.

fluxed entirely with limestone, because doing so would raise the total lime in the slag to a prohibitive amount. Iron must be provided, either from *B* or *D*. To provide it from *B* would be to disarrange entirely the system which has been assumed to represent ideal conditions. If it is provided from *D*, then the cost of fluxing the silica in *E* must be determined on the basis of combining limestone, ore *D*, and ore *E* to form the standard slag, and not by recasting the standard slag and charge and recalculating the unit costs. This latter act is a mistake often made.

The figure correctly obtained should be checked by recasting the charge and calculating the increased cost, charging the whole of the increase to ore *E* and in that manner calculating the cost per ton of *E*. At this point the use of the curves becomes important, because a small inaccuracy in estimating the slag loss is greatly magnified, and individual assays are unreliable, or, rather, the demand for accuracy is greater than that attainable in practical work, and must be reached by following the laws that govern the averages.

It will be apparent that a rise in the silica contents of the mine ore will have the same effect as the purchase of outside siliceous ores; that is, *D* ore will have to be purchased for fluxing if the grade of matte is to be retained and the lime kept below 28 per cent.

The matter would have to be considered in several ways before deciding how to handle it. If *D* ore is expensive, it might pay to alter the base slag and matte. If the rise in silica is due to the mining of too much wall rock, for example, and the contract for the sale of the matte penalizes a drop in grade severely, then perhaps the best way would be to penalize the excess silica in the mine ore by an added charge, say, 14.04c. per unit up to 50 per cent SiO_2 and 20c. for all above that. This is the excess penalty clause seen so often in contracts. The exact method of handling the situation would depend largely on the mine and the mining methods.

Silver Loss Variation

That the copper loss is dependent on the silica in the slag, the grade of the matte, and the iron in the slag has been shown, and the tariff devised covers these points, but does not cover the silver loss. It has been indicated, also, that under certain circumstances the ratio between the silver assay of the slag and the silver assay of the matte is constant if the percentage of copper in the matte is constant, and for convenience in calculation it has been assumed that this is the case. In Table I, 18.3 lb. of copper is calculated as recovered, and the resulting matte assays 233 oz. per ton. If the copper assay of the ore *A* rises to the point at which the recovery of copper is doubled, the silver assay of the matte will drop to 116.5 oz. per ton, the slag assay will drop proportionately, and the loss will be halved. In this case, therefore, the silver loss is not a constant percentage loss, but varies inversely as the copper on the charge.

If *D* ore and *E* ore may be purchased in such amounts that it becomes desirable to add to a thousand pounds of the regular charge another thousand pounds of a mixture of *D*, limestone, and *E*, in proper proportions to form the standard slag, then, roughly speaking, the amount of slag produced on the total charge will be doubled. If ore *E* is a gold ore and contains no silver, the extra slag will be saturated with silver from ore *A*, and the silver loss will be approximately doubled.

The extra copper loss is taken care of by the charge against the iron of the new ores, but the percentage basis of calculating the silver loss again fails. It might be well to make a charge against the iron for part of the silver loss, and a credit to the copper for silver recovery, but this is not common in practice.

Several years ago a series of articles was published in the magazines on what constitutes an ore. Suppose the limestone contains silver. When does it become an ore? The answer is easy from the viewpoint of the metallurgist. As the amount of silver increases, the cost of a unit of CaO decreases until it reaches zero. The moment it passes this point the limestone ceases to be a flux and becomes an ore and will be smelted for its silver value rather than for its fluxing value.

Then, if it be understood that the supply of limestone is greater than the demand by the smelter (which has been understood to be the case, otherwise it would be the price of the limestone that did govern the costs), the situation has fundamentally changed.

The Importance of a Definite Nomenclature

In making these calculations it is essential to think definitely and to be careful not to apply the conclusions to situations to which they are not applicable. This is likely through the lack of a definite nomenclature for the quantities used by the metallurgist, and is particularly so with the words "cost" and "value." The terms "price," "cost," and "value" must be carefully distinguished.

Price per unit of an element, say, CaO, is the number of monetary units paid for the customary mercantile unit, divided by the number of metallurgical units of the element in the mercantile unit.

Cost is the price, plus all the other expenses that are incurred in the utilization of the unit.

Value is the monetary measure of the results obtained by the use of the element in question.

This is simple enough, but these three measures have negative quantities for which there are no adequate differentiating terms. In metallurgical slang it is customary to speak of a negative value as a "red" value, because in bookkeeping negative profits are often entered with red ink. Negative profits are losses, but a negative value is not necessarily a cost, nor a negative cost a value. This is where a misconception is likely to occur.

In Table I and the schedule based on it the cost of a unit of CaO is calculated to be 11.84c. This is the measure of the marginal value of the same unit under these conditions, because it was assumed that the standard slag was the most economical. If the cost were less than the value, another unit would have been added, or vice-versa, but the cost is not a measure of the average value, because then there would be no profits. Or, another small deposit of limestone costing less might be utilized for a part of the requirements and the difference between cost and value would be profit.

What term, then, represents the potential cost of the silica in the ore? What is the correct term for the monetary quantity attached to a unit of lime from a limestone with silver values in excess of the cost? What is the term of these same units when they are in excess of requirements? The terms unit, cost, and value are overworked, and it is necessary to keep in mind exactly what is meant each time they are used, or confusion results.

To return to the silver-bearing limestone. If it be assumed that the cost of a unit of CaO is zero, then the cost of fluxing a unit of silica becomes zero (basis of interchangeability of Fe and CaO), and the cost of a unit of sulphur under the conditions is as follows:

Cost of one ton of sulphide flux	$9.00	
Smelting	4.00	
Fluxing coke ash (Cu for Fe)	.03	
Cost of fluxing SiO_2	.....	
Value of Fe as flux	.....	.....
Copper loss due to Fe at 0.3135 lb. per unit	3.01	.....
Credit for 20 lb. copper at 20c. per lb.		$4.00
Credit for 95 per cent of 1 oz. of silver		1.19
Fe for matte	.....	.....
Credit for overcharge for copper loss in Fe in the matte	.....	.01
	$16.04	$5.20
	5.20	
44 units of sulphur, less 1.15 in matte	$10.84	
Cost of 1 unit of sulphur	25.3c.	

One pound of copper requires 4.665 lb. of sulphur, costing at the above rate 5.9c. It also requires 0.95 lb. Fe to make matte, and as the Fe so used does not drag any copper with it into the slag, there will be a credit to the 5.9c. equal to the penalty on the 0.95 lb. Fe. Estimating this penalty per unit of Fe at 4.5c., makes the credit per pound of Cu 0.21c., leaving the net deduction per pound of copper 5.69c. Adding this to the 2.5c. marketing expense, makes a total deduction per pound of copper of 8.19c., and a net value of 14.31c. (market price, 22.5c.).

The iron going into the slag has no fluxing value, but drags 0.3135 lb. Cu with it per unit of Fe. This, at 14.31c. per lb., is equal to 4.49c. per unit of Fe, which is the amount it should be penalized. The schedule would then be:

CaO, fluxing value	Nil
Fe, penalty per unit	4.49c.
SiO_2	Nil
Sulphur, value per unit	25.3c.
Copper, market price, less	8.19c.
Treatment, per ton	$4.03

This is all based on the assumption that the 36 per cent matte is the most economical to use, and that FeO and CaO may be substituted for each other in the slag without inconvenience.

At first it may appear strange that the cost of sulphur has been increased by the presence of silver in the limestone, but a moment's consideration will show that such is actually the fact. The existence of cheap flux has taken away the fluxing value of the sulphide flux, leaving the whole expense to be borne by the sulphur. Although the price of sulphur has risen, the cost of treatment of the ore *A* has decreased. Also, as the cost of fluxing the silica has disappeared, most of the cost of treatment is directly referable to the pound of copper.

If it be assumed that 28 per cent CaO in the slag is the maximum permissible, the question of iron corresponding to the silica enters, and the costs must be calculated on that basis.

Practically, the sulphur usually brings the accompanying iron in sufficient quantity, although in practice I once met the problem just mentioned. The main supply was a siliceous ore, 60 per cent SiO_2, 20 per cent Al_2O_3, 10 per cent $BaSO_4$, and very little iron. The sulphide flux did not furnish enough iron, and the standard slag contained 25 to 28 per cent CaO and 3 to 5 per cent BaO; and to get even this it was necessary to buy oxidized iron flux. The marginal unit of cost was therefore regulated by the cost of a unit of Fe in the oxidized iron flux.

Practical considerations usually eliminate enough factors so that the problem is capable of solution.

Returning to the silver-bearing limestone: If the silver values are so great that the value of a unit of CaO is no longer a charge but is a credit, then the limestone is an ore, and the effect would be to change the standard slag so as to run with as great a percentage of CaO in the slag as possible, and presumably costs would be based on a unit of CaO rather than of SiO_2. Owing to the predominating amount of siliceous and irony ores, this is an improbable situation, though an entirely possible one, so the treatment of an ore with excess iron will be considered instead.

Assume ore *F* with 3 per cent Cu, 4 per cent SiO_2, 40 per cent Fe, 12 per cent S, 6 per cent CaO, 4 per cent Zn, and 2 per cent Al_2O_3. Quartz can be purchased at $2 per ton, delivered, and assume that it contains 100 per cent SiO_2.

Table IV shows a charge calculated from these materials. The slag loss has been calculated by interpolation from Fig. 4 and by using 80 per cent of the results so obtained after correcting for grade of matte by Fig. 2. Owing to the presence of bases other than FeO and CaO, results in practice will be lower than those shown in Fig. 6, and 80 per cent is merely an arbitrary figure. In actual cases, curves would be drawn to suit the results obtained, with due consideration to the source of the additional bases.

If it be assumed that the most advantageous slag is

TABLE IV. CALCULATION OF CHARGE

Material	Amount, Lb.	Ag Assay	Ag Oz.	Cu %	Cu Lb.	SiO_2 %	SiO_2 Lb.	Fe %	Fe Lb.	CaO %	CaO Lb.	Al_2O_3 %	Al_2O_3 Lb.	Zn %	Zn Lb.	S %	S Lb.
F	1,000	1.0	0.5	3.0	30.0	4.0	40.0	40.0	400.0	6.0	60.0	2.0	20.0	4.0	40.0	12.0	120.0
Quartz	240	...	...	.....	.....	100.0	240.0	....	.....	....	.....	....	.....	...	.....	.....	.....
Coke	(124)	...	...	.....	.....	10.0	12.4	3.0	3.7	0.4	0.5	5.0	6.2	...	.....	.....	.....
Total	1,240	...	0.5	.....	30.0	.....	292.4	....	403.7	...	60.5	...	26.2	...	40.0	....	120.0
Slag	933	...	...	0.597	5.56	.....	.....	....	.....	...	.....	...	.....	...	.....	.....	.....

120 × 0.15 ÷ 0.25 = 72.0 = Wt. of Matte
30 — 5.56 = 24.44 = Wt. of Cu in Matte
24.44 ÷ 72 = 34.0 = % of Cu in Matte
72 × 0.36 = 25.92 = Wt. of Fe in Matte
403.7 — 25.9 = 377.8 = Wt. of Fe in Slag
377.8 × 1.287 = 485.7 = Wt. of equivalent FeO

Slag Content:	Lb.	%
SiO_2	292.4	31.4
FeO	485.7	52.1
CaO	60.5	6.5
Al_2O_3	26.2	2.8
ZnO	30.0	3.2
Miscellaneous	38.2	4.0
Total	933.0	100.0

Copper:	
Matte assay, per cent	34.0
Cu loss, per cent	18.5
Cu loss, lb. per ton of charge	8.96
Cu loss, lb. per lb. of Fe in charge	0.01472
Cu loss, lb. per unit of Fe in charge	0.2945

N.B.—The slag loss is calculated from Fig. 6, but only 80 per cent of the tabular values are taken to allow for effect of elements not shown in curves. See text.

The cost of treating a ton of *F* ore as in Table IV would be:

Smelting 1,000 lb. ore at $4.00	$2.00
Smelting 240 lb. quartz	.48
Cost of 240 lb. quartz at $2.00	.24
Copper loss, 5.56 lb. Cu at 20c	1.11
Total cost of treatment of 1,000 lb	$3.83
Total cost of treatment of 1 ton *F* ore	7.66

The cost of a unit of SiO_2 would be 6c.

that shown in Table IV, containing 31.4 per cent SiO_2, the cost of a unit of silica is its value under these conditions.

If another calculation be made using 1,000 lb. of *F* ore and 500 lb. of quartz, it will be found that under the same conditions as to sulphur recovery and other factors, the slag will contain 45.9 per cent SiO_2 and the cost of treatment of a ton of *F* ore, calculated in the same manner, will be $8.86. The difference of $1.20 is due to the addition of 520 lb. (two charges), of quartz, and measures the loss resulting from that addition, which amounts to $4.61 per ton of quartz. Then the value of a ton of quartz for raising the silica in the slag from 31.4 to 45.9 per cent would be negative in amount to $4.61 per ton if the cost price is included. Omitting the price paid it would have a negative value of $2.61 per ton; that is, the company would have to charge $2.61 per ton for smelting it to come out even.

I have shown the manner in which these figures are obtained, but the conditions which may exist at any given plant are infinite in their possibilities, and each case must be decided after a study of the whole situation.

In the examples cited conditions have been simplified by certain assumptions, because it is impossible in an article of this nature to allow for many of the important influences, such as furnace design, efficiency of the power plant, and general conditions, which affect the choice of a standard slag. In practice there are always conditions that permit of similar assumptions; otherwise there would be many indeterminate equations.

When Ores Are Purchased on Flat Rates

Take the case of a custom smelter operating on purchased ores which are available in such kinds and quantities that no fluxes are required, and which are purchased on flat rates, with no allowance for fluxing values. Here (as in all cases) the value of the marginal unit of each element will be determined by its effect on the metal recoveries or treatment expense and not by the cost of obtaining it. The fact that the smelter is not paying for the iron and lime does not affect their value (or vice-versa), but is merely a matter of business policy, which in this case is probably, but not necessarily, incorrect. Another plant may be buying ores on an elaborate schedule that has developed a similarly satisfactory ore supply, and yet the prices and deductions may bear no direct relation to the values, though entirely correct as to business policy.

The determination of the value of the marginal unit is no easy matter, and depends on both theory and practice. Furnace conditions vary so much from day to day that it is impracticable actually to test the effect of the addition of the marginal unit. The only way is to test the effect of substantial changes, so as to give points for plotting a curve from which the effect of minor changes may be deduced. This applies to theoretical calculations as well as to practical work, because few of these curves lie in straight lines, that is, ten units probably do not have ten times the effect of one unit.

Constant use of slide rules and approximate assays tend to make one a little careless in the use of such things as coke ash and 0.01 per cent in slag losses. In the calculations for daily furnace control they are of little importance, but in the determination of values they are very important if correct conclusions are desired. A rightly used graph is the micrometer which enables one to measure the value of the marginal unit and obtain results that are correct beyond the accuracy of the daily control samples and assays.

That these schedules of costs and values may be determined in more than one way has been demonstrated. They may be calculated to suit a general condition already existing, or for a prospective change in conditions. In either case, they are the means of measuring the cost of treating any ore the analysis of which is known. By their aid a company buying custom ores, or smelting ores from a number of different mines of its own, or a number of different ores from the same mine, is able, as a matter of routine, to calculate the profit and loss on each ore and thus find leaks that otherwise would escape notice. The mine superintendent will be able to recognize the exact value of each element, and so avoid those ores, or grades of ore, that do not yield adequate returns and to accomplish the mining so that the total profits from mining and smelting will be a maximum.

The schedule offers opportunity for graduating the charges and profits in accordance with the work done. Smelting a ton of neutral ore means just what it says, but smelting a ton of quartz when silica is in excess implies that three tons of limestone also must be smelted, or the treatment of four tons. The schedule also helps the ore buyer to develop and bring to the smelter at the most favorable terms the material required for operation. A miner may have an ore with 50 per cent excess SiO_2. The smelter, to cover treatment cost, adds to the treatment charge of a neutral ore a penalty of 15c. per unit excess SiO_2, a total penalty of $7.50 more than the charge on a neutral ore. If the smelter made a flat rate, this amount would have to be included in it, and there would be no recourse.

With the treatment charge in the penalty form, the miner may be able to sort out half of this excess silica at a cost to him of, say, 5c. per unit and save the difference. The world is better off because the cost of recovering the valuable elements from the ore has been reduced.

The schedule also enables two or more competing companies to go into a mining district and sort out the ores automatically in accordance with the cheapest total cost of smelting all the ores, and the greatest profit to the mining industry.

How To Apportion Fixed Expense

One phase of the matter is important and has not been mentioned; that is the fixed expense. Certain expenses at every plant will be incurred, whether the amount smelted is one ton per day or one thousand. These are the fixed expenses. The remainder for the sake of convenience may be called operating expense. Let it be assumed that the operating expense is $3 per ton and the fixed expense $1,000 per day and that there are no intermediate semi-variable expenses. The cost of smelting one ton per day would then be $1,003 per ton; the cost of smelting two tons per day would be $503 per ton, and for ten tons per day the cost would be $103 per ton, and so on until for 1,000 tons per day the cost would be $4 per ton. If the works are operating on a basis of one ton per day it is clear that the cost is $1,003, but the additional cost of smelting another ton is not $1,003, nor even $503, but only $3, and any price collected for the smelting of the second ton, if more than $3, will reduce the amount of loss in the $1,000.

Coming down to reasonable figures, if the works are

operating on a basis of 1,000 tons per day, and receiving $4,000 for the work, the company is neither losing nor gaining; it is costing it $4 per ton to smelt, and it is receiving $4 per ton. If, however, a contract for an additional thousand tons at $4 per ton is made, it receives $8,000 for the work done on the two thousand tons, and the cost is only $7,000; so it makes a profit of $1,000. This additional ore can be smelted, without loss, at $3 per ton, although the smelting cost is $4 per ton at the moment. It is to take care of this difference in effects between operating costs and overhead expenses that the various divisions of cost on this basis are required, and because the costs cannot be as sharply defined as in the example, the classification must be more extensive.

Therefore, in making up the schedules, charges, costs, and values of the different elements, it is evidently necessary to consider the purpose and manner in which they are to be used, before deciding on the bases to be taken in the calculations. It is the bank balance at the end of all the operations that is the final criterion of the correctness of the calculations.

Japan's Control of Chinese Iron Ores

The total known reserve of China's ores of such character and situation as makes them available for modern development amounts to about 416,000,000 tons, according to *North China Commerce*. Of this Japanese or Sino-Japanese companies own about 200,000,000 tons. The Chinese government retains its title to about 130,000,000 tons, including the Molingkwan ores.

The principal deposits owned or controlled by the Japanese are as follows:

Penshihu in Manchuria. Two grades of ore are found here, one containing 68 to 71 per cent iron and the other 35 to 40 per cent. No figures are available as to how much of the ore is high grade and how much of low grade, but the total tonnage is estimated at 80,000,000 tons.

Anshanshan. The tonnage here is estimated at 30,000,000, and the grade varies from 31 to 66 per cent.

Chinlingchen, in Shantung, where there are 37,000,000 tons and probably more of ore averaging 65 to 70 per cent iron. The Japanese government is retaining this deposit to supply the imperial steel works in Japan and seems to be planning to ship ore only.

Tayeh, nominally a Chinese company and actually dominated by Japan. The reserve is about 30,000,000 to 35,000,000 tons, which has already been contracted for delivery in Japan.

Tungkuanshan, at one time in possession of the British, now owned through the Sino-Japanese Development Co. by Japanese. This is an overrated deposit, having only about 2,500,000 tons of probable ore, but being well situated near the Yangtze.

Fangchanghsien, in Anhuei on the Yangtze, with 15,000,000 tons of ore containing 58-63 per cent iron. This is the main reliance of the new Oriental Steel Co., recently floated in Japan.

There is not one important deposit of iron ore in China controlled by foreigners except Japanese, and they now control about one-half the known reserve and are reaching for more. Much of the 86,000,000 tons in the hands of private Chinese firms may be expected to pass into Japanese hands.

The Molingkwan deposits are important because of their grade and situation. A steel works supplied by them would be in position to undersell any other works in China. The ore reserve is 30,000,000 to 40,000,000 tons and the grade is good. The deposits are situated about twenty miles south of Nanking.

China is not as rich in iron as was formerly supposed. The per capita reserve is less than one-seventieth of that of the United States, and the whole Chinese reserve, including that granted to Japan, amounts to only about six years' output from the Lake Superior region.

All these figures take no account of such deposits as those of Shansi for the reason that they are not available for modern industry. The individual bodies of ore there are so small that it is not feasible to mine enough ore in one day to keep a modern furnace running. These deposits are only available to feed small native furnaces which supply a limited local demand for pots and similar articles. From the point of view of modern industry they do not exist.

Gold in the Appalachians

As early as the sixteenth century, the Appalachian Mountains were known to contain deposits of gold, according to the U. S. Geological Survey. When the Spanish explorers came to southeastern North America the Indians showed them some rich nuggets and ornaments of gold that had been mined in the southern Appalachian region. In the seventeenth century the Spaniards mined for gold in Georgia. During the eighteenth century litt'e gold mining was done anywhere in the Appalachians, although some writers have supposed that gold was found in North Carolina before the Revolutionary War.

Just at the close of the eighteenth century placer gold was discovered in Cabarrus County, N. C., and considerable prospecting was done in that region. The output of gold from South Carolina in 1829 was reported to be worth $3,500. From that time until the Civil War gold mining was a considerable industry in the southern Appalachians, and although the rich fields of California lured many miners from these lower-grade eastern deposits, the fever in California really stimulated gold mining in the East.

During the Civil War and for several years after it little gold was mined in this region, but in the seventies, eighties, and nineties gold mining there was more active. The gold-mining industry in the central Carolinas is not now flourishing, because the supply of free-milling ore is decreasing and because the gold cannot be extracted from the lower-grade sulphide ore at a profit.

"With Pitfall and With Gin"

"The oil-flotation process is to the mining industry of Yavapai County what the gin mill is to the great cotton business of the Salt River Valley in Maricopa County," says an article in the *Salt Lake Mining Review*. The gin mills of Arizona must then be more prosperous than those of New York and surrounding parts east, north, west, and south. At 75c. and up per "shot," the local mills doubtless make a considerable individual profit, but the overhead and underground are said to be high, and customers are not always what they seem. Neither are the beverages that the vintners sell (we hear). Curiosity as to the mysterious + habit + plain human cussedness are making the wake of Old John Barleycorn "some occasion"!

Geologists of Note

George Davis Louderback

AN ORDERLY MIND, imagination, and initiative, with an appreciation and love for humanity and nature, are basal elements in the make-up of a scientist. George Davis Louderback has, step by step, reached an eminent position as a geologist. The qualities which have contributed to this successful outcome have also endeared him to his associates and his students. At present he is professor of geology and dean of the College of Letters and Science of the University of California. His parents were pioneer residents of San Francisco, and he received his education in the California schools and University. On graduation he became an instructor in the University of California under Dr. Andrew C. Lawson. Soon after he became professor of geology in the University of Nevada. An incident will show the conditions that a new and, in this case, a youthful instructor has to face when installed in a strange place. On Dr. Louderback's arrival at the University of Nevada, and after meeting the president, he was turned over to the superintendent of buildings and grounds, to be shown his classrooms and facilities for instruction. The superintendent was gruff and direct. "Here's your place," he said, as he ushered the worthy professor into a small room. The walls of the room were the worse for wear, and the windows were covered with scratches where students had tested out minerals on the glass. In the center of the room was a heap of all the minerals of the department. It looked liked a sample ready for flattening and quartering. There was a battered table and four broken chairs. Dr. Louderback looked around at the superintendent—and smiled, to be met by an answering smile.

GEORGE DAVIS LOUDERBACK

After serving two years as research assistant of the Carnegie Institution of Washington, Dr. Louderback returned to the University of California in 1906, and was rapidly promoted until he attained the professorship of geology in 1917. The value of sound preparation in fundamentals rather than a high degree of specialization was demonstrated by his selection to take charge of a geological expedition into China for the Standard Oil Co. of New York. On the completion of his work in North China he conducted geological work for the Chinese government in Szechuan, and finished his Far East experience by three months investigations in the Philippines.

When the United States entered the war in 1917 the State Council of Defense for California organized a series of scientific investigations. Dr. Louderback was made chairman of the committee on geology and mineral resources. Under his direction a survey of the chrome and manganese resources of California was organized, with a corps of volunteer assistants, for the purpose of encouraging the mining of these minerals. In 1918, the U. S. Geological Survey placed him in charge of the investigation of chrome and manganese resources of California and the U. S. Bureau of Mines secured his services for similar work on the manganese resources of the same states. Dr. Louderback has marked organizing ability and possesses the faculty of getting others to work with him. His most effective work is in geological research and in the instruction of geological students. He made studies of Basin Range structure, the Truckee sedimentaries, and the oil-bearing formations and stratigraphy of the Pacific Coast. He discovered the gem-mineral benitoite. His methods are thorough, and mining and geological students from the University of California are well grounded in fundamental geology.

A wide field is covered by Dr. Louderback's activities. He served as secretary for the Cordilleran section of the Geological Society of America for a long time, and in this capacity stimulated research work on Pacific Coast geological problems. He assisted in founding the Seismological Society of America. He was secretary and later chairman of the Pacific Association of Scientific Societies. He is a fellow of the American Association for the Advancement of Science, member of the Washington Academy of Science, California Academy of Sciences, American Institute of Mining and Metallurgical Engineers, American Geographical Society, Geological Society of America, Minerological Society of America, the Committee on Sedimentation of the National Research Council, and many clubs.

Classifier Efficiency

Improvement Over Former Methods of Determination Suggested — Elutriation Preferable to Screening Tests

BY R. T. HANCOCK
Written for *Engineering and Mining Journal*

IN HIS recently published "Handbook of Ore Dressing," p. 214, A. W. Allen gives the following formula:

$$\textit{Efficiency of Classification} = \frac{100\,(t + t')}{F}$$

where t = tonnage of oversize in the coarse product, t' = tonnage of undersize in the fine product, and F = total feed tonnage. He gives an example of the performance of a Dorr classifier treating 1,100 tons, and producing a coarse-product discharge having 84.9 per cent of plus-65 mesh and 15.1 per cent of minus-65 mesh, the fine-product discharge consisting of 5.8 per cent of plus-65 mesh and 94.2 per cent of minus-65 mesh, the tonnage of coarse-product discharge being 790 and fine-product 310. The efficiency is given as 87.5 per cent.

The efficiency of a classifier cannot be obtained in this way. The problem is exactly similar to the obtaining of the efficiency of an operation of ore-dressing where what is desired is the separation of two substances of different nature, ore and waste, whereas in classifying the separation desired is of substances differing in size —coarse and fine. Therefore the same type of formula is applicable to both cases.

The formula which I have evolved for obtaining the necessary information (*Mining Magazine*, September, 1918, and *E. & M. J.*, April 10, 1920), may be written:

Percentage metallurgical efficiency

$$= \frac{\%\ \textit{recovery} - \%\ \textit{concentration}}{\%\ \textit{of waste in feed}}$$

or,

$$= \frac{\%\ \textit{concentration} \times (\textit{enrichment ratio} - 1)}{\%\ \textit{of waste in feed}}$$

In applying the formula to the classifier the percentage recovery is the weight of the plus-65-mesh material in the spigot or coarse products, expressed as a percentage of the weight of the plus-65-mesh material in the original feed, assuming that 65 mesh is the size at which it is desired to divide. The percentage concentration is the weight of the spigot or coarse product expressed as a percentage of the weight of the original feed. The enrichment ratio is the ratio of the percentage of plus-65-mesh material in the spigot or coarse product to the percentage of plus-65-mesh material in the original feed. The percentage of waste in the feed becomes the difference between 100 and the percentage of plus-65-mesh material in the original feed.

Calculated in this way the efficiency in the instance given by Allen is shown to be 68.1 per cent, and not 87.5 per cent, and it can further be shown that Allen's formula would give positive values of efficiency in cases where no segregation of the coarse sizes into the spigot product took place, but where the classifier merely split the feed into two parts of similar nature, in which case it would, of course, be operating with zero efficiency as a classifier.

In a classifier making only two products, spigot discharge and overflow, or in classifiers of the Dorr type, it is not necessary to know the weight of the products made, or of the feed. The efficiency can be calculated from the screening assays alone. In multiple-spigot classifiers it is necessary to know what percentage the weight delivered by each spigot is of the original feed. It is necessary, of course, to know the screening assays of feed, spigot discharge, and overflow in the former instance. A mere statement of the screen assays of the final products is useless, as Allen states.

Complete statements of the performance of multiple-spigot classifiers appear to be rare in technical literature. The only one I have seen is given in Richards' "Textbook of Ore Dressing" on p. 228. Where this table is reproduced in "Peele" (p. 1,662) the percentages which each spigot product and the overflow form of the original feed are omitted, as though the importance of this information had not been realized.

The data which Richards gives are as follows:

SIZING TEST OF FEED AND PRODUCTS FROM RICHARDS, DEEP-POCKET FREE-SETTLING CLASSIFIER

Size, mm.	Feed	1 Spigot	2 Spigot	3 Spigot	Overflow
On 0.907	0.41	0.0	1.49	0.0	0.0
0.566	20.55	52.5	17.90	0.40	0.12
0.427	14.84	24.62	19.90	1.50	0.31
0.351	12.39	14.30	23.60	3.70	0.43
0.277	9.87	5.22	18.19	6.90	0.81
0.206	9.05	2.61	9.60	12.09	0.43
0.137	10.03	1.00	8.20	29.50	3.67
0.130	3.59	....	0.79	8.21	0.62
0.107	4.08	0.38	1.81	37.75	0.31
Through	15.25	....	....	....	93.50
Totals	100.06	100.18	100.48	100.05	100.20
Weights	99.77	26.10	40.297.	129	16.09

These figures require emendation, which has been attempted below, the figures being weights of sizes in each product.

ADJUSTED REPORT OF SIZING TEST

Size, mm.	Feed	1 Spigot	2 Spigot	3 Spigot	Overflow
On 0.907	50	0	50	0	0
0.566	2,064	1,339	716	7	2
0.427	1,477	644	802	26	5
0.351	1,314	352	895	60	7
0.277	991	134	726	118	13
0.206	786	70	454	244	9
0.137	962	27	343	531	61
0.130	271	....	47	209	15
0.107	573	8	57	504	4
Through	1,512	....	....	....	1,512
Totals.....	10,000	2,583	4,090	1,699	1,628

The result obtained will vary according to the particular mesh selected as a standard for the performance of the classifier, and to bring this difference out I have calculated the efficiencies for each size for all the products, as follows:

PER CENT EFFICIENCIES

Dividing on	1 Spigot	2 Spigot	3 Spigot
+ 0.907 mm.		not computed	
+ 0.566	47.3	48.7	26.6
0.427	46.0	54.0	31.8
0.351	42.7	62.7	37.1
0.277	39.2	71.0	40.5
0.206	37.4	74.7	48.7
0.137	33.5	74.2	58.7
0.130	32.1	70.4	67.9
0.107	31.1	68.1	93.5

In calculating the efficiencies for the second spigot it must be remembered that its feed is the overflow from the first compartment, and not the original feed, and this overflow must first be calculated. The whole calculation is, in fact, exceedingly tedious, and anyone who thinks that the result obtained is of service in adjusting the classifier is welcome to that conclusion.

Taking the results as they stand, it is apparent that the maximum efficiency of the first spigot is associated with division on a comparatively coarse size; of the second spigot on a medium size; and of the third spigot on a fine size, which is as it should be. The high value obtained for the third spigot by dividing on plus 0.107 mm. mesh is unreliable, as much adjustment of the original figures was necessary here. The values obtained for the first spigot appear low.

In my opinion the grading assay of classifier products is best obtained by elutriation, and not by screening. By the latter what is found is the efficiency of the classifier as a screen, which it is not. Flaky particles present in the feed will be carried over to the later spigots, whereas by virtue of their size, as determined by screening, they should be found in the earlier spigot product. Perhaps this fact may be the cause of the poor showing made by the first spigot in this instance. The feed is stated to have been crushed by rolls through a 1-mm. screen.

Efficiencies for the overflow have not been calculated. Like the tailings of an ore, they would show the same efficiencies as the concentrate (here the third spigot product), but of minus sign.

Ice Formations Underground

By C. M. CAMPBELL

Written for *Engineering and Mining Journal*

FEW minerals crystallize in such beautiful forms as ice. The first illustration shows a view in an abandoned manway in the Granby mines at Phœnix, B. C. The manway is on an incline and contains a stairway. Along the roof run the electric wires, with drop lights where required. The upper part of the manway became blocked with ice, and, in the perfectly

FIG. 1. AN ICE CRYSTAL CLINGING TO AN ELECTRIC LIGHT GLOBE

quiet area below, crystals of large size have developed thickly along the walls and roof such as shown clinging to the light globe. Crystals almost a foot in diameter and of wafer thinness are quite common in the Granby mine.

Similar conditions prevail along old drifts, and in passing through abandoned stopes one occasionally comes among a congregation of ghost-like figures such as are shown in the second picture. These usually gradually disappear with the arrival of warm weather. Owing, however, to the working out of the deposit in recent years, the lower levels have been connected with the surface of large openings and permanent ice has gradually formed in the winter in the abandoned parts of the different levels, filling up, partially or completely, the drifts and stopes. The air currents in the summer take on the temperature of the ice, and one can now stand at the mouth of one of the tunnels,

FIG. 2. ICE STALAGMITES IN AN ABANDONED STOPE

on the hottest summer day, and face a blast of freezing temperature. No. 3 tunnel has an unobstructed opening 9 x 15 ft. in size; the ice on the floor is still dry 15 ft. from the portal, and has furnished a supply for the citizens all summer. Though the temperature may be 80 deg. F. outside, icicles are still forming on the timbers, and the tunnel is a veritable region of winter.

Ensenada's Mineral Resources

The Ensenada Consular District, Mexico, according to *Commerce Reports*, is rich in gold, silver, copper, lead, zinc, and iron. Magnesite is shipped from Magdalena Bay. The Mexican onyx quarries near Santa Catarina are the largest in the world. An immense surface deposit of iron ore at San Isidro gives much promise. Since 1911 mining has been on a decided decline, the one exception being the El Boleo copper mine, at Santa Rosalia, where a French company has produced steadily and successfully for a number of years. The company has its own smelter and operates its own ships, important considerations under the recent political conditions.

With the return of normal conditions and proper guarantees this will be a most attractive region for mining investments, for there are abundant surface showings and other indications that in Lower California important ore deposits await the pick of the prospector.

BY THE WAY

Camille Industrielle

While conducting a research in polyglot technical literature, the consulting engineer observed that a report on the Alsatian potash field, by Monsieur Camille Binder, would soon be published by the *Societé de Chimie Industrielle.* Hastily jotting down the information on the back of an envelope, he continued on his special assignment. Late that night, Mrs. Babel conducted a little research of another character; technical only in its thoroughness. Being of a jealous disposition, next day she prevailed upon an ex-canteen-worker to assist her in a bit of translation. "H'm'm; let's see—*Industrielle* certainly means 'working girl.' Well! An affair of that kind may be all right for a Camille; but I tell you *we* never had such goin's on around *our* canteen!"

Some Salt

Under the heading "Some Salt" the U. S. Geological Survey informs the public, in Press Bulletin No. 455, that the volume of salt in the ocean is enough to cover the entire surface of the United States to a depth of 8,500 ft. Authorities on technical writing will agree that this use of the word "some" is not to be tolerated. It really looks as if the Survey wanted more people to read the bulletin and was descending to the use of levity to achieve its end. It would be, indeed, a whale of a lot of salt. This, we presume, is what the Survey would intimate. Besides "whale" is quite befitting a fish story and "lot" has been associated with sodium chloride ever since the days of Sodom and Gomorrah.

Quien Sabe?

A seeker after truth asks concerning a hypothetical zinc mine in the Joplin district: "What should be the average daily production of a vein, 3 x 5 ft., in a tunnel mine?" An open non-competitive examination will be held on this subject beginning at once. Both sexes may enter, but male eligibles will be preferred. A vacancy may be filled at a local sanitorium from the results of the examination.

Florida Water Preferred

The *Financial Times* of London recently published the prospectus, here given in full, of the Chemical Research Association, of Berlin, which purposes to extract gold from sea water. Unfortunately for us the term of subscription expired on Aug. 20. The announcement reads as follows:

THE CHEMICAL RESEARCH ASSOCIATION
Treasurer: O. A. SCHUESSLER
Berlin SW 19 (Germany).

BERLIN, April 20, 1920.

Dear Sir,

It is quite a well known fact, that the formerly richest gold mines of Transvaal and Alaska have become less productive and threaten to exhaust in time, as has already been the case with the goldfields of Australia and California. If no new goldfields are discovered, we shall surely steer into a gold famine.

In fact a scarcity of gold would certainly make its appearance, if it would not have been succeeded to discover new sources, the enormous abundance of which overshadows all previous wealth of gold and will cover the whole worlds demand for gold for ever!

This vast source of gold is—the ocean—the sea-water!

Careful chemical research of the sea-water brought forward the result, that it contains per ton about a grain of gold in solution. Conclusively there exists dissolved in the ocean a quantity of gold equal to 800,000 millions tons, that is to say 500,000 times as much as gold has been produced ever since the beginning of our chronology until this day!

THE CHEMICAL RESEARCH ASSOCIATION has set herself the task to secure these treasures from the ocean by a special extracting process. For technical and hydrographical reasons the South-East-Coast of U.S.A. would best serve the purpose. As soon as the preparatory work is done the works for the extraction of gold from the sea-water will be erected. In view to this THE AMERICAN GOLD EXTRACTING COMPANY with a share-capital of $1,000,000, divided into 10,000 shares, each to be $100 nominal, will be founded. The privilege to purchasing these shares will be reserved firstly to members of The Chemical Research Association. By subscription instalments of not less than 50% are to be made.

How lucrative the produce of gold is, show the gigantic profits of the gold producing concerns. The California Consolidated Virginia Mines for instance paid out in 1877 not less than $22,680,000 dividends to their shareholders.

With regards to the calculation drawn The American Gold Extracting Co. will be in a position to pour out a dividend of about $100 on each share by a years produce of only 4 tons gold already, i.e. 100%. As far as experience goes the rate of exchange of the share must then rise to at least the 15-fold. Each $100 share will then fetch $1,500 or more on exchange. As the raw-material—the sea-water—in any quantity is free of charge at our disposal, nothing can prevent us from extracting the ten-fold amount of gold and pouring out the ten-fold dividends, whereby the shares will rise to an unimaginable height!

The works of the American Gold Extracting Company will be erected on American soil and therefore is it important to get the American public interested in this enterprise and to admit English & American citizens into the Board of the concern.

From this point we beg to apply to you with the request to join the membership of The Chemical Research Association. The annual contribution for membership amounts to $10 only; by this means the membership entitles you to the privilege of purchasing 10 shares of The American Gold Extracting Company at par. Further shares are to be had at the rate of $130, whereby the Funds for International Scientific Research of our Association will be benefited with the residues and the members' fees. You will thus have the satisfaction to aid science and to increase your money as you can easily make at least $1,500 to $2,000 out of $100.

But the less wealthy who could not even afford to secure $100 for a share, shall have the opportunity to become patron of science and to earn money at the same time. He needs only become member of The Chemical Research Association and subscribe a sum divisible by 10 (at least $10). He will then receive the amount of dividend corresponding to his share.

Do not let this never returning opportunity slip by without securing a membership and shares and thus increasing your fortune! Please fill up and sign the enclosed form and kindly return it to the Treasurer of The Chemical Research Association.

Speedy dispatch is entirely in your own interest as the term of subscription expires on Aug. 20, 1920.

Warning

We warn our readers that one of these days they are going to read something like this in the *Engineering and Mining Journal:* "The limestones lie uncomfortably on the quartzite beds." Our compositors are not geologists and they have not yet learned that there is such a word as "unconformably." So far, we believe, we have always caught the error but we feel it in our bones that sometime it is going to slip in.

CONSULTATION

A Mining Agreement

"What share of profit is it customary to receive from a mining company when the ore fields belong to one party who locates the ore, and is sole owner, and the other party being a company who furnish the equipment, machinery and attend to the operating, mining, handling, treatment and commercial disposition of the product; the owner party acting as superintendent and actively engaged in directing the enterprise?

"This is identified in two classes:

"A—Owner party who owns the ore and works in any capacity.

"B—Equipping and operating party, who furnishes the money for machinery and labor, but none of this party does any actual labor and only supplies necessary money for equipment and operating.

"I believe the profit divided equally between A and B would be commensurate until B receives the amount of B's investment and 20 per cent annually for the time it took to return B's amount in half the entire profit. If B invested $10,000 and it was paid back to him in his share of profit in two years, then he would receive 20 per cent on the $10,000 for two years. Time being specified as that in which the mine is in operation, Sundays and legal holidays considered same as working days if in a time when the mine is in operation, but if operation should be suspended for a specified time, winter months, or indefinitely, interest to discontinue.

"Individual conditions vary according to the circumstances to be taken into consideration, but A having valuable copper bearing ore, is located near railroad with labor and supplies convenient, is favorable to B's operations.

"I would like your opinion here, and to learn if I can, what is generally customary."

The sum and substance of your statement indicates that one party is to be sole owner of the property and is to be actively engaged as superintendent directing the enterprise, while the other party is to furnish the equipment and attend to the financing of the operation, for which arrangement profits are to be equally divided between the two parties with interest at the rate of 20 per cent annually paid to B, the party contributing the finances.

This strikes us as an unusual arrangement. In the first p'ace all A is virtually doing is raising a certain amount of money to operate the property, paying an unusually high interest rate *until all of B's money is returned* and hoping to pay back the principal in short order. All business connections between A and B will presumably be severed when this condition has been fulfilled. The provision that the interest discontinue during the time that the mine operations are suspended is a peculiar restriction, as an unsuccessful attempt to work the property, followed by a shutdown, would free party A from paying interest on the borrowed funds. Although this arrangement is unfair to B there are other considerations manifestly unjust to A's share in the agreement.

It should not be forgotten that in the proposed development of the property A has nothing to lose financially and everything to gain, but B's position is just the reverse. No provision has been made for a possible failure in the enterprise, something which is the rule more than the exception in the run of mining ventures.

As to what arrangement is generally customary in working mineral deposits, no hard and fast rule can be laid down. Frequently a bond and lease are taken upon the property with the intent of working, and paying for the land at regular intervals. Such a plan ordinarily contemplates complete purchase of the prospect or mine. If the owner desires to retain an interest in his property an agreement whereby he is to retain part possession in return for privileges granted to the operating parties might be consummated, but a plan such as you have outlined provides that one party act purely as a financier and does not become part owner of the property.

An important consideration and one which is not included in your statement is the condition of the mine. Its prospective value depends chiefly upon the profits to be won from ore exposed and the possible profits to be obtained from the extension of ore beyond exposures disclosed by development.

Is it assured beyond a shadow of a doubt that the enterprise will be successful? Have the risks incident to mining operations been carefully considered? The unwisdom and impracticability of laying down any general rule to follow is due to the difference between mining and other business ventures.

Ability to raise sufficient capital to work a mine alone would depend upon the owner's credit and a showing of the property sufficiently satisfactory to induce capital to finance the operation.

The arrangements that can be made are largely dependent upon individual circumstances and no generalization can be made. There should be concessions on both sides, and a willingness for both parties to cooperate in deciding upon what are fair and business-like terms.

The sale of a mining property or a prospect and a mutally satisfactory arrangement to purchaser and seller has been a bone of contention in the mining industry ever since mines were first operated. The vendor frequently lets his imagination picture the value of his property and its possibilities unduly great whereas the purchaser ordinarily adopts a Missourian attitude. An inability to reach an agreement has hindered the development of many promising mining prospects.

With the thought that perhaps some of our readers may care to contribute their experiences in arrangements for purchasing, selling, or operating mining properties, we are publishing your letter and our reply in these columns.

Highest Quicksilver Average Price

"What was the highest monthly average price of quicksilver during the war?"

The highest monthly average price of quicksilver during the war as indicated by *Engineering and Mining Journal* quotations was attained in February, 1916, with an average quotation of $283.50 per flask of 75 lb, which is almost four times the current quotation of about $75 per flask.

THE PETROLEUM INDUSTRY

Financial Record of Scotch Oil-Shale Companies

Details of the Amalgamation, Effective in November, 1919, by Which Practically All the Going Companies Were Merged Under the Control of the Anglo-Persian Oil Co., Ltd. —Attractive Dividends Heretofore Paid

Written for *Engineering and Mining Journal*

IN VIEW of the serious endeavors now being made to inaugurate in the United States commercial operations in oil-shale treatment, the financial records and results of the companies which have been engaged in this special industry in Scotland for more than half a century become of special interest. Data on the subject have been accorded critical consideration abroad, incidental to a large merger plan which has just been effected, in which practically all of the going Scotch companies have been amalgamated and united to the interests of the Anglo-Persian Oil Co., Ltd., a world-wide organization in which the British government has a large financial interest and a dominating control.

The records indicate that the Scotch operators in oil shale have not always had clear sailing financially, even in recent years. Financial data of the early stages of the business are not available, but records of corporate readjustments, and the fact of the practical merging of a large number of small companies into five large companies reflect the earlier financial history of this Scotch industry. Even in recent years, after the technical difficulties incident to the infancy of any industry have been overcome, all of the companies except one, the Pumpherston, experienced financial embarrassments, as is evidenced by the varying and in some cases consistently low dividends declared. In fact, some of the companies report "nil" dividends as late as 1910 to 1914. The dividend record of the Pumpherston company, the premier of the Scotch oil-shale companies, is, however, as satisfactory as anyone could reasonably expect, and the general valuation placed on all of the securities of these companies in the financial plan of the new merger, which was only effective late in 1919, is evidence of the substantial soundness and large potentialities of the business.

In May, 1919, the Anglo-Persian Oil Co., Ltd., after a long and thorough investigation, submitted a proposition to form and adequately finance a merger of the Scotch oil-shale companies. This plan was obviously in pursuance of the expansion program of that powerful organization in the oil industry, but it was also opportune for the oil-shale companies, for they were having some difficulty in maintaining sufficient production to keep the refinery installations, incident to the development, going at full capacity. Trouble was also threatened because of the demand of the miners for increased wages equal to the greatly ascending scale of the British coal miners, and general conditions rendered it unlikely that the Scotch shale oil companies could maintain separately the large earnings made during the war. The proposal of the Anglo-Persian company was duly accepted by the requisite number of shareholders, and the change in control and policy and the unification of the shale-oil companies became effectual in November of 1919.

SHARE DISTRIBUTION OF THE NEW COMPANY

The new company, known as the Scottish Oils, Ltd., has a capital of £4,000,000; shares, £1. Of the total shares 3,000,000 are 7 per cent (non-cumulative) participating preference shares and 1,000,000 are ordinary shares. After the payment of 7 per cent on the participating preference shares the ordinary shares will be entitled to receive 7 per cent, and of the remaining distributable profits, the participating preference shares will receive 25 per cent before further distribution of profits to all shares alike are made. It is expected that the new company will be able to pay 7 per cent on the preference and ordinary shares and to leave a surplus for both classes of shares equivalent to at least a like dividend return.

The basis of the acquisition of the several unit companies and a record of their capital and of their dividends follows:

THE PUMPHERSTON THE LEADING COMPANY

The principal of the Scotch companies, the Pumpherston Oil Co., Ltd., registered 1883, capital £450,000, shares £1, has a very good dividend record. In addition to paying 6 per cent on £150,000 first and second preference shares, the distributions on the ordinary shares, of which £285,000 were issued, have been as follows: For 1900, 20 per cent; 1901, 15 per cent; 1902, 7½ per cent; 1903, 20 per cent; 1904 and 1905, 30 per cent; 1906 to 1910, inclusive, 50 per cent annually; 1911, 30 per cent; 1912, 35 per cent; 1913, 35 per cent and a bonus of £1 3s.; 1914, 25 per cent; 1915, 10 per cent; 1916, 25 per cent; 1917, 40 per cent; 1918, 40 per cent; 1919, 40 per cent; 1920, 30 per cent. In the report of April, 1919, a credit balance of £221,324 is shown, which, after deducting dividends on preference and ordinary shares, and transferring £14,000 to new plant account, and writing off £3,064 for improved plant and £3,000 for reserve fund, left £36,059 carried forward. The reserve is given as £110,000.

The £1 shares have the following recent market quotations: 1917, highest, £4 25/32; lowest, 79s.; 1918, highest, £5⅜; lowest, £4¼; 1919, highest, 98s.; lowest, 81s. 9d.

This company was taken into the merger on the basis of £5 for the ordinary shares, payable in fully paid 7 per cent (non-cumulative) participating preference

shares of a par value of £1 each in Scottish Oils, Ltd.

Young's Paraffin Light & Mineral Oil Co., Ltd., registered in 1886, had a capital of £700,000, made up of 175,000 shares of £4 each, and 113,202 shares were issued. In addition, the company had an issue of first and secured bonds totaling £300,000. The issue of £150,000 of second-charge bonds, in addition to 6 per cent, carried a right to interest at twice the dividends payable on the ordinary shares. The dividends on ordinary shares from 1919 average about 4 per cent only. The data are somewhat complicated by the preference interest payments made on the second-charge bonds of £150,000. The financial showing is not good, a fact which is mirrored in the offer of the merger to purchase the whole issued capital at 63s. per share, payable in preference shares in Scottish Oils, Ltd.

The Broxburn Oil Co., Ltd., registered in 1877, had a capital of £335,000, of which £100,000 was represented by preference shares, entitled to a cumulative dividend of 6 per cent. The dividends on the ordinary shares since 1900 have averaged better than 10 per cent (free of tax). The merger paid £2 each for the whole of the ordinary shares, the £2 being payable in preference shares in Scottish Oils, Ltd.

The Oakbank Oil Co., Ltd., registered in 1886, had a capital of £300,000—£100,000 preferred and £200,000 ordinary shares. The dividends from 1900 have ranged from 7½ to 15 per cent; since 1915 they have been 15 per cent (free of tax). The company had reserve funds of £61,940. This company was taken into the Scottish Oils, Ltd., at 37s. 6d. for the ordinary shares, payable in preference shares.

James Ross & Co. (Phillipstown Oil Works, Ltd.), which had a capital of £135,000 in £1 shares, was taken over by the Scottish Oils, Ltd., at 25s. per share.

In the same financial program, the Scottish Oils, Ltd. purchased for £150,000 cash the British Petroleum Co. and the Homelight Oil Co. Both of these companies were oil-distributing organizations, the latter already controlled by the Anglo-Persian Co. The inclusion of these companies in the merger is significant of the general program to broaden the Scottish Oils by finding facilities to distribute not only the products from the shale but crude oil products as well.

Will Get Crude from Anglo-Persian Company

The Anglo-Persian Co. has made a contract, effective January, 1923, to supply the Scottish Oils, Ltd., with crude oil to keep its refineries going to full capacity, a factor which will tend greatly to insure maintenance of dividends for the new company by removing one of the drawbacks, which was inherent under the plan of independent companies, of depending principally on oil from shale for the refinery supplies. It is expected that a shale will also be made from the unification of management and of equipment and facilities. The marketing organization and facilities of the strong parent company will also be of great advantage to the new operations.

It has long been known that the Scotch shale companies found it advisable and profitable to mix part of their oil product with refined oil bought in the market from the producers and refiners of crude oil. It is presumed that this practice will be continued with increased advantage under the new close financial relation with a strong producer and refiner of crude oil.

The plans of the new company, or its parent organization, the Anglo-Persian Co., with regard to the extension of the engagements in the oil shale business are not yet known. The Anglo-Persian Co. recently has made investigations of the oil shale of New Brunswick, and an agent of the company has been negotiating with some of the owners of oil-shale land in the Colorado-Utah field. It is not likely that the Scotch operations can be largely expanded because of the limits of the shale deposits which are available for cheap mining. Other deposits in the British islands have been investigated, and it is reported that they will be made the basis of new operations soon, but whether by the interests allied with the Scottish merger or not is not disclosed. It is expected that extensive improvements in equipment will be installed at the Scotch plants at an early date.

Polish Oil Industry Important, But Faces Many Difficulties

Oil is, at present, the chief reliance of Polish export and the principal means by which the Minister of Finance hopes to bring about a real stabilization of the valuta (exchange). Just now there is a crisis in the Polish oil industry according to *Commerce Reports*.

When the Polish administration of Eastern Galicia began, foreign capital rushed into the oil fields. Before the war British (chiefly Canadian), French, Belgian, German, and Dutch capital was invested, although the majority control was in Austrian hands. After the close of the conflict more British, French, and Belgian money was brought in so rapidly that during the last year practically the entire industry has changed hands, refineries as well as oil fields. French capital now predominates. One of the largest French companies is the Mugeot, which acquired its lands by direct purchase from the proprietors. There is very little American capital, only one company being recorded.

The oil situation in Galicia has developed rapidly. New wells are being constantly discovered and brought in. By June 15 the owners of oil-bearing lands in Galicia would no longer give options. They would consent only to sell outright.

The crisis in Polish oil dates back to 1909. It was accentuated during the war, particularly after the Russion invasion of Eastern Galicia. For several years no search was made for new wells and no oil extracted from the old ones, and only recently has the oil business been revived. The industry was greatly in need of organization and equipment. Former Austrian restrictions had to be removed, and war devastation repaired. A peculiarly irritating difficulty arose because, before the war, practically all technical materials used in the Polish oil industry were imported from Bohemia, Upper Silesia, and Sweden. Independent Poland found all these sources of supply closed, which occasioned great delay in production.

For the year 1919 the total production of oil in all Poland was slightly over 83,000 tanks of a capacity of 10,000 kg. each. These figures do not compare favorably with the total of 107,000 tanks produced in 1913 (the last pre-war year) and the 205,000 tanks produced in 1909.

The Panstwowe Urzad Naftowy (State Bureau of Oil Control) has had many labor, production, and price troubles. For instance, the coal supply of Upper Silesia, which is necessary to the full development of the Galician oil wells, is as yet not assured to Poland.

Relation of the Bureau of Mines to the Oil Shale Industry

Activities Should Be Devoted to Technologic Rather Than to Economic Factors—Problems Include Standardization of Testing Methods and Retorts as Well as the Securing of Much Fundamental Data

By J. O. Lewis
Chief Petroleum Technologist, U. S. Bureau of Mines
Written for the *Engineering and Mining Journal*

IN THE opinion of the United States Geological Survey, with which opinion the Bureau of Mines is in accord, the future petroleum needs of the United States cannot be supplied from domestic oil fields. Three alternatives are possible: Curtailing the consumption, going abroad for petroleum supplies, or developing other home resources for petroleum and its products.

The first choice is obviously not acceptable. The second is not the most desirable, in that the United States would no longer be self-sustaining, and might be forced to face unpleasant possibilities of foreign complications. Furthermore, there is no assurance of continued adequacy of such supplies. Although the country is now drawing upon importations, and must continue to depend upon that source of supply, it is highly desirable that the development of every possible domestic resource be promoted; and of the home resources, the oil shales constitute the most promising potential reserve of raw material from which petroleum products or substitutes can be derived. It seems inevitable that this latent resource must be drawn upon for at least a large part of the future needs of this country.

At present the oil-shale industry can be termed an "industry" by courtesy only. It is struggling to establish itself, but as yet is not on a demonstrated commercial basis. It is endeavoring to work out the technique of mining the shale, of recovering the oil, and of refining the products almost without precedent or example as a guide, for the Scotch shale industry can hardly be considered a satisfactory source of technical methods and practice, because of dissimilar conditions, particularly economic, and shale oil cannot be refined in precisely the same way as petroleum.

Promoters' Methods Hamper Development

The industry is faced with a host of problems, both technical and economic, which demand solution. Much of the money now being spent in endeavoring to prove the commercial feasibility of oil shale is being wasted because of the lack of fundamental data. The pioneers in the industry, upon whom falls the brunt of the struggle, are largely groping blindly, duplicating efforts or spending money in unproductive experiments. The larger and more conservative interests, although fully believing in the future of the oil-shale industry, are for the most part hanging back before risking their money, until the data necessary for the engineering appraisal and development of the industry become available. The industry, moreover, is beset with a plague of promoters who are mulcting the public and who threaten to discredit the future of the business by their extravagant claims or dishonest methods. Both the public and the legitimate interests should be protected by the Federal Government's making available reliable and impartial technical information from which correct opinions of the possibilities of the industry may be formed.

The Bureau of Mines has given much thought as to what part it should take in this development, and has sought the opinions and advice of most of the responsible engineers and men concerned. There are two broad phases, one the economic and the other the technologic. Under the economic may be grouped the cost factors, which include the cost of mining, of crushing, of extracting the oil from the shale, and of refining the oil products or recovering the byproducts. The other economic factors are the value of the products and byproducts and their present and future markets. Upon the favorable balance of cost against sales value of the products is dependent the profit, and this, of course, is the key to the situation, for the industry will attract capital only when it can be demonstrated that a reasonable probability exists that it can be put on a profitable basis. The margin between costs and values of products is the most important factor to be learned in the oil-shale industry.

Government Financing of Commercial Operations Not Recommended

The technologic factors include the richness and extent of shale deposits, methods of mining, methods of crushing, methods of extracting the oil to get the largest yield of the best quality oils at the least cost, how to refine the oil, and how to recover byproducts. Obviously, the economic and technologic factors are intimately associated, one controlling the other, but the main concern of the Bureau of Mines must be with the technologic rather than with the economic factors. This is particularly true of the strictly commercial aspects, for although estimates may be made of the various costs, and of the values of the products, only commercial operations will establish these factors definitely.

The Bureau of Mines holds that it must concern itself mostly with the technologic factors, and that the industry, through private enterprise, must answer the commercial questions. The Bureau therefore does not recommend that the Government finance commercial operations, because it believes private interests rather than the Government should make such a commercial test, but believes that investigations by the Bureau of Mines of the technologic factors will yield information of the utmost value to private enterprises in working out the economic factors.

What experimental and investigational work the Bureau undertakes must necessarily be controlled by the means at its disposal. At present its means are meager, and it has been unable to take up the many opportunities for service which await its attention. What it does in future is largely contingent upon the

appropriations it receives. The Bureau has plans prepared which are outlined in a general way in the paragraphs following. All of its plans are predicated upon the central idea that the chief asset and the greatest faculty for service of such a Federal agency as the Bureau of Mines is its disinterested position, which enables it to perform functions which no private concern, no matter how wealthy, can fulfill. It is in position to get information which a private concern would hold as a trade secret. Thus it can become a clearing house of information for the industry.

Much data of a fundamental nature should be supplied by the Bureau. This information will be necessary before the design and operation of retorting and refining plants can be undertaken intelligently. These fundamentals include such factors as the rate of heating of the oil shale, transmission of heat through oil shale, the effect of size of particles of shale, the effect of vacuum or reduced pressures, the effect of high pressures, the effect of steam atmospheres under various conditions of temperature, and the effect of atmospheres of other gases, such as carbon dioxide, carbon monoxide, hydrogen, and illuminating gas. Better ways even than retorting the oils from the shales may be found, such as the use of hot solvents.

Some of the Refining Problems to Be Solved

Investigations should also be conducted on the quality of products. An important problem is how to refine shale oils with the least loss and expense, for it is not generally appreciated that in the Scotch shale industry, which produces an oil superior to any so far examined from American shale retorts, there is a refining loss, including the coke, of 25 per cent. Unsaturated hydrocarbons, olefines and diolefines, are formed in retorting the shale, which are removed in ordinary refining processes. Investigation should be made as to how to minimize the formation of such undesirable compounds, or how best to treat them in refining.

Promotion literature emphasizes the large values in lubricants derived from shale oil. The information of the Bureau of Mines is to the effect that the lubricating values are likely to be very disappointing, as all lubricants examined so far indicate a quality of small value. It is possibly inherent in the breaking down of the organic materials in oil shale that only lubricants of low viscosity will be formed, and therefore they will be of small value, but the conditions under which these compounds are broken down will have an important influence on the final products, and a way to make good lubricants may possibly be discovered.

Testing Methods Should Be Standardized

The Bureau of Mines can serve a useful purpose by standardizing testing methods. Test methods which are reproducible, so that one can obtain comparable results, are always needed; otherwise there is no way of fitting together the odds and ends of information gained from all sources. These should go further than mere laboratory testing methods, and the Bureau of Mines contemplates the acquisition of a shale deposit of approximately average constitution, which will be used as a standard shale so that such shale can be sent to various plants to be tried out or to be tried out under various conditions, or to be used in research, that results, wherever obtained, will be comparable, inasmuch as all will be conducted on the same material. This will permit of a comparison of various methods, of differing conditions, and of many types of retorts; also it will provide a basis of comparison of different varieties of shale.

The standard shale should be supplemented by a standard retort which can be established at some convenient point by the Bureau of Mines. Such a standard retort should be a one-unit Scotch retort, not because the Scotch retort is believed necessarily to be the retort ultimately to be adopted by the American industry, but because it is one well understood, both as to design and operation, and in which reproducible results can be obtained. It is therefore the most suitable for establishing a present standard.

Byproduct problems are sure to be an important feature of investigation. One of the big questions today is whether to construct and operate the retorts to treat the maximum tonnage of shale, or to reduce the tonnage in order to recover ammonia. Prevalent opinion in the United States is that it will not be profitable to recover ammonia. The Bureau of Mines has seen no convincing facts supporting this contention, and it is one of the subjects which should be investigated.

Other byproducts have been mentioned. Not only should study be made of possible byproducts, but of prospective markets for them. Such markets may be already established, or they may be established by substituting oil-shale products for other materials.

Materials of construction should also be studied. For example, the capacity of the byproduct coke oven has been increased by two or three fold since its adoption in the United States, largely through the employment of silica brick, with a high rate of heat transmission, to replace the firebrick used in Europe, which has a much lower rate of heat transmission.

Although mining does not lend itself readily to investigations, the Bureau of Mines can be of great service on this subject also. The Bureau publications contain no data that can serve as a precedent for mining American oil shales, as shale is not entirely similar to any other material. In open works it is perhaps most similar to the handling of cement rock, limestones, and like substances. In drift mining it is more similar to mining coal, yet with certain differences. The Bureau investigations might well include the best kinds of powder to use, the best system of mining and breaking down the rock, safety devices, mine timbering, and all allied and complementary subjects.

Oil Shale in Esthonia

The use of oil shale in Esthonia is increasing rapidly, according to a bulletin of the Guaranty Trust Co. The Esthonian Ministry of Commerce sells several thousand poods every day, and receives about 500 orders of about 225 poods each. The small purchasers burn the shale in their dwellings, and several large factories also have adopted this fuel. Experiments in heating ships' boilers with oil shale are planned.

Oil Exploration in Ensenada, Mexico

Considerable exploring for oil was done in 1919 in the Ensenada consular district, Mexico. Concessions have been granted and some geological surveys made, but no drilling operations were conducted. More active prospecting is expected in 1920, and Canadian interests are reported as planning to drill near Rosario.

Oil Shales and Petroleum Prospects in Brazil

Suitable Processes of Extraction Will Make Available Large Petroleum Resources That Are Abundantly Distributed Throughout That Country

By Horace E. Williams*

BRAZIL has extensive petroleum resources in oil shales, which are found in different parts of the country. Although many of the shales are rich, suitable processes for the extraction of the oil are lacking, and at present only a few small experimental plants are producing oil by distillation from shales. The regions including the Upper Amazon, the Acre, the Rio Negro and the Peruvian frontier have received little investigation, although they appear to be the most promising fields for explorations in the country.

Information as to the detailed structure and distribution of the rock formations in the State of Maranhão is very meager. The Permian beds are exposed along the Rio Parnahyba for over 1,000 km., and, generally, over the southern and eastern half of the state. These beds are covered largely by thinner Triassic and Cretaceous formations. Although the Permian rocks have undergone considerable folding in a minor way, the material in hand seems to indicate a general synclinal structure across the state, with the main axis bearing northeast-southwest. On the middle reaches of the Itapicurú and Mearim rivers, bituminous shales are found together with calcareous sandy and marly beds associated with limestones.

Shales Overlain by Boghead Coal

At the occurrence on Rio do Inferno, the beds strike east and west with a dip of 30 deg. south. The lowermost bed consists of a boghead coal, somewhat similar to the Marahú beds of Bahia, overlying a thick bed of well-laminated bituminous shales. In the bed of the Rio Mearim, the bituminous shales are covered by a limestone with siliceous and gypsiferous intercalations. These beds have a southerly dip and are covered by over 50 m. of flaggy sandstones. At Grajahú, farther southwest, the same gypsiferous limestone occurs, but without the bituminous shales, which, if present, are below the water level of the river. The limestone dips northeast with the strike N. 60 deg. W. and it is covered by a red conglomeratic sandstone. Similar beds are found in the extreme southwest of the state and in northern Goyaz, on the Rio Tocantins.

The plains and lowlands of central Maranhão are covered by the lateritic formation, and observations on the underlying rocks are difficult, especially as regards character and structure. Samples of the oil shale from this region gave the following results on analysis: Bitumen, 36.5 per cent; clays, 22.6 per cent; soluble carbonates, 40.8 per cent; and on slow distillation 450 l. of oil (about 100 gal.) per ton.

Shales rich in oil are found at several places along the coast of Alagôas. The series of rocks to which the oil shales belong are found along the coast about Cape S. Agostinho, Rio Formosa, Tamandaré, Abreu da Una, and in some other localities, but at these places the unweathered shale does not appear. Farther along the beach, in latitude 9 deg. 3 min., at Maragogy, the oil-bearing shales appear at and a little above tide level. At this place they show a wrinkled synclinal structure and outcrop frequently from this point south, as at São Bento, Camaxó, Japaratubá, and in front of Pitinguy, in latitude 9 deg. 7 min., where they are exposed at low tide.

At Barreira do Boqueirão, north of the Porto das Pedras, the shale exposed has a thickness of 2 m., with a probable thickness of 3 or 4 m. in all. At Camaragibe, the shales form a wave-cut terrace about 150 m. wide, the dips observed were from 5 to 10 deg.

Shales are exposed at Barra do Santo Antonio and at Riacho Doce, in latitude 9 deg. 36 min. The exposure at Riacho Doce is quite similar to those already mentioned. Several pits were sunk, and the shales were found to be richer than those at Camaragibe.

Bituminous Beds in Bahia Have Appearance of Asphalt

The better-known occurrences of bituminous rocks in the state of Bahia are those found in the vicinity of Marahú and southward along the coast. These rocks occur along the coast in the flat region for considerable distances and widths. The Marahú deposits are about 30 km. long by about 15 km. wide. The beds contain both fresh-water and marine fossils. Resting up against the old crystalline rocks is a fresh-water series of rocks containing plant remains, which is largely impregnated with bituminous matter. This is characteristic of the western inland part of the basin. Farther east, resting on these beds, are found limestones containing marine fossils and also with impregnations and masses of asphalt. The beds are of Cretaceous age. The appearance of the bituminous and carbonaceous material everywhere is notable. These materials occur in the most varied forms. In the beds are found large solid impregnations having the appearance of asphalt; and at some points the bitumen is viscous like pitch. At Taipúmirim, cavities a meter or more in diameter and quite deep are filled with black bituminous matter. An analysis of this material gave the following: Volatile matter, 30 per cent; non-volatile combustible matter, 14 per cent; ash, 56 per cent. The material contains much pyrites. Alcohol dissolves little of it. On evaporation, it gives a brown rosin. Ether dissolves most of the material and benzol dissolves it almost completely.

Composition and Products of "Turfa de Marahú" Similar to Bituminous Coal

Resting on the Cretaceous beds, a clayey lignite is found in the lower beds of the Tertiary bluff formation of this coast. In the lowermost beds, almost at tide level, the boghead coal known as the "Turfa de Marahú" is found. This is different from other known bitumens, and is light yellow in color, with brown and gray veins, which appear as stratification planes. An analysis gave the following: Water (at 110 deg.) 2.75 per cent; volatile matter, 71.65 per cent; non-volatile combustible matter, 9.75 per cent; mineral residue, 15.85 per cent. The residue consists principally of silica, much alumina, lime, and grains of quartz. Horizontal beds of this material are exposed for a depth of 3 to 4 m. at the mouth of the Rio Arimembeca, and are said to continue in depth for over 15 m. On slow distillation, this coal yielded 430 l. of crude oil to the ton. The density of this oil varies between 0.870 and 0.880. Neither in

*Abstract of a paper presented at the St. Louis Meeting of the A.I.M.E., September, 1920.

color nor aspect does the rock have any resemblance to coal, but the composition and the products are those of the bituminous coals. It is not a bituminous schist, because the organic material greatly predominates over the mineral. The great mass of the rock is composed of yellowish-brownish humic material.

Farther south from Marahú, in the vicinity of Ilhéos, oil shales similar to those of Alagôas are found in several places. These are small exposures of beds that appear along the coast between the granite points, which hereabouts frequently extend down to the ocean. The area of these seems to be relatively small; and, although they are rich in oil content, their value remains to be determined.

Shales in São Paulo

The Tertiary basin in eastern São Paulo, on the upper reaches of the Rio Parahyba, is perhaps 150 km. long by 15 to 20 km. wide. Over a considerable part of this basin, oil shales have been found. They outcrop 10 to 15 m. above the Parahyba near Tremembé and Pindamonhangaba, where they are being mined. Quantities of these shales have been used at the gas works in Rio and in São Paulo at various times, especially during the war, on account of the shortage of coal. There exists at Taubaté a small plant for the distillation of oil from these rocks. An analysis of the shales gave the following composition: Crude oil, 13.08 per cent; water, 23.36 per cent; gas and loss, 4.02 per cent; mineral residue, 58.64 per cent. On slow distillation these shales yielded 27 gal. of crude oil per ton.

Extending through São Paulo, Paraná, Santa Catharina, Rio Grande do Sul, and into Uruguay is a persistent bed of black petroliferous shale in the upper Permian series of rocks, which is known as the "Iraty Black Shale." At places, the petroleum of these shales has been oxidized into albertite or other substance resembling coal, as about Piracicaba and Rio Claro, in the State of São Paulo. Material rich in oil is found between São Pedro and Piracicaba in beds of considerable thickness. A company has been formed recently in the city of São Paulo for explorations in this region. Near Rio Claro, several miles farther north, some drilling has been done during the last few years in an effort to find oil.

At about the same geological horizon as the above outcrops, but at a much lower level deposits of asphalt occur along the Rio Tieté near Porto Martins. Farther south, in the foothills of the Serra de Luiz Maximo, between Tatuhy and Botucatú, a heavy bed of bituminous sandstone is found some distance above the black shale. Recently a plant has been installed near São Gabriel, in Rio Grande do Sul, for the distillation of oil from these shales.

Though extensive faulting and fissuring of the strata of this region may have allowed the escape of contained petroleum in the vicinity of faults and fissures, but these are neither so numerous nor so extensive in area as to preclude its existence in other places. If one may judge by many examples known today, important deposits may still be present in the strata even in the vicinity of the eruptive dikes. Be this as it may, with regard to petroleum the fact is abundantly demonstrated that, in these shales, Brazil has an inexhaustible supply which only requires suitable processing to become available.

Oil Possibilities in Cuba

By E. R. Suarez Murias

Written for *Engineering and Mining Journal*

Petroleum indications are numerous in the Island of Cuba and consist of asphalt deposits, oil seepages, gas exudations, veins of native bitumen, pitch pools, bituminous limestones and inclusions of petroleum in igneous intrusions in the rock formations of the country.

On several occasions during the latter part of the last century attempts have been made to locate oil deposits, but without success. In the last four or five years oil has been struck at two points, one in the province of Havana, at Bacuranao, the other one in the province of Matanzas, at Cantel. At the latter place oil was found recently, whereas at the former they have been pumping it for the last two or three years. Close to the boundary of Santa Clara, at a place called Motembo, where several shallow wells were sunk years ago, two wells were sunk last year to a depth of approximately one thousand feet which produce naphtha. The owners assert that they will place this product on the market as soon as they can erect containers. Gas flows from the above mentioned relatively shallow wells at the estimated rate of one hundred thousand cubic feet per day.

Some forty wells have been drilled in Cuba during the last four or five years, although the work done has been conducted in a haphazard way. Little is known about the structural conditions of the subsoil, for geology has rarely been taken into account. In selecting sites for drilling more attention, perhaps, has been given to easy access for prospective purchasers of stock than to other more important factors governing the success of the enterprise. No conclusions should be drawn, therefore, from results thus far obtained in the attempts to locate oil. It is not surprising that the work done should have practically extinguished local interest in oil.

The oil showings above enumerated extend over miles of territory, appearing more or less conspicuously parallel to the strike of the long axis of the island over a distance of six hundred miles, covering an area of at least six thousand square miles.

Petroleum Never Considered a Metal

In reply to an inquiry as to whether petroleum ever has been classed as a metal or a semi-metal, the Director of the United States Geological Survey has made a reply which negatives any such assumption. Besides being unaware of any classification of that nature the Director does not know of it ever having been used. His reply follows:

"Neither any of my associates in the U. S. Geological Survey nor myself knows of any scientific or other classification of minerals and mineral substances published since 1867 in which petroleum is placed with the metals or semi-metals.

"As you probably are aware, oil, asphalt, and other bitumens of similar nature and origin were associated with coal even by the early mineralogists and metallurgists of the sixteenth and seventeenth centuries, and in many works were therefore placed in the stone and earthy groups, rather than with the metals. I doubt if extended research of early literature will reveal a mineral classification of any date in which these substances are put with the metals."

NEWS FROM THE OIL FIELDS

Oil Men Meet at Denver

From Our Special Correspondent

The Independent Oil Men's Association will hold its twelfth annual convention and exhibition in Denver beginning Sept. 28. The exhibition will be held in the Auditorium, and the different types of oil-producing and drilling machinery and equipment will be shown. A four-day session for papers and discussions is planned. A special train left New York on Sept. 24 for Denver, going by way of Chicago and Kansas City.

Frantz Pool, in Cat Creek, Wyo., Field Shows Enlargement

From Our Special Correspondent

Measurement of the flow of the well of the "56" Co., in the Cat Creek field, so-called because there are 56 units in the corporation, shows an output of 1,400 bbl. daily, with the sand drilled into only several feet, and it was believed that this production might be further increased. The significance of the bringing in of this well is the suggestion of the proving of the large Frantz pool for a distance at least of 3,000 ft. The Frantz No. 2 well continues production at a rate of 2,000 bbl. daily with the neighboring well, 440 ft. distant, owned jointly by the Frantz and the Midwest, showing an output of 3,500 bbl.

Walker Brothers' well, being drilled for interests idenified with the Anaconda, situated in the Cat Creek field, has an oil showing in a shale bedding above the sands, more than six barrels of oil being baled daily. This well is in what is known as the West Mosby structure, where are found the Frantz wells. Another Walker Brothers well is situated in the Kootenai dome, also in the Cat Creek field, 30 miles distant from the Frantz wells, and this well also is reported in, but the report lacks confirmation.

The Department of Oil and Gas of the California State Mining Bureau reports for the week ending Sept. 4, 1920, 16 new wells (587), 26 tests for water shut-off (859), 26 deepening or redrilling jobs (606), and 5 wells abandoned (146). The numbers in parantheses are the totals for the year to date.

More than 150,000 acres of public lands in California and Wyoming were classified during August by the U. S. Geological Survey as being within known oil and gas structures. This brings the total acreage thus classified under the Mineral Leasing Act to 340,000 acres.

Increase in August Kentucky Production

From Our Special Correspondent

Production showed up better during August than the preceding month. Wells that were completed number 255, an increase of 66. New production was 9,479 bbl., an increase of 1,950 bbl. Work under way totals 1,075 bbl. Runs of the Cumberland Pipe Line Co. for the week just closed, in eastern Kentucky, show a total of 76,808 bbl., or a daily average of 12,801 bbl. Activity in new business is again in the western part of the state. No. 3 on the C. E. Wilson lease in Warren County, rated at 50 bbl. when it was brought in a month ago, has been shot and is now good for 200 bbl. daily production. Whittle No. 1 on the Bailey farm, Warren County, was shot Thursday at 440 ft. The well started flowing at once, and production is rated at 300 bbl. Whittle No. 4 also has been brought in, rated at 125 bbl. Two others are going down on this lease.

Butler No. 1 was drilled in four miles south of Franklin in Simpson County, rated at 19 bbl. an hour. The well is only 150 ft. deep. It is the first shallow well in the county and has boosted the value of leases.

Phillips & Stewart recently brought in No. 3 on the Willoughby lease, Allen County, estimated at 200 bbl. a day. No. 1 and 2 are small wells. No. 4 is going down.

New Wyoming Pipe Line in Operation

Other News from Wyoming Fields

From Our Special Correspondent

The thirty-nine-mile pipe line of the Illinois Pipe Line Co. from Rock Creek oil field to the Midwest Refining Co.'s plant at Laramie is in successful operation. About 160 bbl. per hour are being transported.

The Bolton Creek Oil Syndicate recently brought in a 1,200-bbl. well in the Bolton Creek field, 20 miles southwest of Casper, Wyo. This is the largest producing well in the district.

The Riverton-Wyoming Refining Co. plans to raise capital for improvements and enlargements on its Riverton refining plant. The plant in treating Dallas field (Lander County) crude oil must now market the heavy residue which could be converted into lubricating oils at a considerable profit.

Part of the Graybull plant of the Midwest Refining Co. will be altered to treat oil from the Hamilton field. This oil is heavier than that treated heretofore and a different handling is required. About 40 per cent of the plant's capacity will be employed on the work of obtaining the new supply.

Texas Oil Transportation Agreement Ended

Empire Pipe Line Co. To Transport Oil in Cars

From Our Special Correspondent

The oil transportation agreement between the Texas Co. and the Empire Pipe Line Co., a Cities Service subsidiary, regarding crude petroleum transportation between Burkburnett and Healdton, has been cancelled by mutual agreement, to take effect Oct. 1. Hereafter all oil gathered at Burkburnett by the Empire Pipe Line Co. will be transported in tank cars.

The Empire Gas & Fuel Co. filed suit in the federal district court at Dallas on Sept. 7 against the Lone Star Gas Co. for $450,000 for alleged breach of contract. The suit arises from failure of the defendant to comp'y with the terms of a contract to buy 17,000 acres of land near Mineral Wells.

The Manhattan-Texas Petroleum Co., of Dallas, has acquired the property of the United Petroleum Trust Co. for a consideration said to be about $1,000,000. The Manhattan-Texas Co. will also purchase, if possible, producing areas in the Breckenridge field in accordance with its policy of expansion. The fourteenth consecutive monthly dividend of 2 per cent was paid recently by this company.

Breckenridge, Stephens County, is probably the most active and most interesting oil field in Texas today. The discovery of oil within the city limits has caused the formation of many small companies and partnerships, and drilling on many of the city blocks is now under way. Few, if any, dry holes have been drilled in Breckenridge, it is reported, and a big increase in production is expected in a few months.

Hull, Liberty County, was the field of chief interest on the Gulf coast during the second week of September. Five wells were completed with a total initial production of about 9,000 bbl. The largest well was the Morris-Phillips No. 11 of the Gulf Production Co. flowing 7,000 bbl. from 3,100 ft.

At West Columbia, Brazoria County, the No. 1 Abrams well of the Texas Co. is flowing about 8,000 bbl. through the drill stem after having sanded up due to a cave in the open part of the hold. Several wells in the immediate vicinity of this big well are being rushed to completion, including those of the Gulf Production Co., Humble Oil & Refining Co., Monarch Oil Co., Crown Oil & Refining Co., and Texas Company's offset wells. The deep well of the Gulf Production Co., which was completed recently at 3,700 ft., making about 700 bbl. has increased its flow so that nearly 2,000 bbl. are now being obtained.

ECHOES FROM THE FRATERNITY

The Federated American Engineering Societies

The Organizing Conference held in Washington on June 3 and 4, 1920, was attended by 140 delegates representing over 71 organizations, having an aggregate membership of over 110,000, or over 80 per cent of the aggregate membership of all of the organizations that were invited. The questions have been asked: "Who are these men?" "Who were invited?" and "Who should be interested in this movement?"

The Federated American Engineering Societies is constituted of engineering and allied technical organizations, whose chief purpose is the advancement of the knowledge and practice of engineering and allied technical arts which are not organized for commercial purposes. It includes the individual engineer and the allied technologist, who is represented through the society or societies of which he is a member which have membership in the organization. It includes civil, mining, metallurgical, mechanical, electrical, testing, railway, highway, municipal hydraulic, sanitary, water works, bridge, agricultural, illuminating, heating, ventilating, refrigerating, safety, radio, fire protection, automotive, industrial, military, marine, naval and chemical engineers, and architects, naval architects, chemists and geologists. These branches of engineering and allied sciences cover the whole range of activity in this country upon which is dependent its economic success. It has been said that

"Everywhere you look you see the work that the engineer has done."

FORMATION OF THE FEDERATED AMERICAN ENGINEERING SOCIETIES

Engineers and allied technologists have been content to perform their work without notoriety. Dating from a period considerably before the war, the engineer was gradually developing class consciousness, and a desire to be of public service. This desire was intensified as a result of the World War and led to the formation of Engineering Council by the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers. In the effort of these societies to determine in what way their activities could be improved and rendered of greater value, committees were appointed by each, and these committees in turn appointed conferees, who met and organized the Joint Conference Committee. As a result of this intensive desire for service, it was the unanimous opinion of the Joint Conference Committee that a comprehensive organization was desirable that could speak for the engineering and allied technical professions wherever engineering experience and technical training are involved, as well as in matters of common concern to these professions. This recommendation was accepted by the constituent societies who authorized the Committee to call, without delay, a conference of representatives of national, local, state, and regional engineering organizations and affiliations for the purpose of bringing into existence the comprehensive organization recommended. The Committee issued a call to 110 engineering and allied technical organizations for the thoroughly representative Organizing Conference of June 3-4, 1920, which has been characterized as the greatest event in the engineering history of this country.

This Organizing Conference, without a dissenting vote, created The Federated American Engineering Societies and authorized the Joint Conference Committee to act as the Ad Interim Committee between its adjournment and the first meeting of its governing body, American Engineering Council.

PROGRAM

First Meeting
of American Engineering Council
of
The Federated American Engineering Societies

Washington, D. C.

November 18-19, 1920.

All Sessions in Small Ball Room
New Willard Hotel

THURSDAY, NOV. 18, 1920.

MORNING SESSION

8:30 A.M. *Registration.*

10 A.M. *Opening Session of American Engineering Council of Federated American Engineering Societies.*

1. *Call to Order by Richard L. Humphrey, Chairman, Joint Conference Committee.*
2. *Election of Temporary Chairman.*
3. *Election of Temporary Secretary.*
4. *Appointment of Temporary Committees:*
   (a) *Program.*
   (b) *Credentials.*
   (c) *Constitution and By-Laws.*
   (d) *Nominations.*
   (e) *Plan and Scope.*
   (f) *Budget.*
   (g) *Resolutions.*

AFTERNOON SESSION

2 P.M. Address, *"Engineering Council," J. Parke Channing, Chairman.*

2:30 P.M. *Discussion of the field of activity for The Federated American Engineering Societies.*

FRIDAY, NOV. 19, 1920.

MORNING SESSION

9 A.M. 1. *Report of Committee on Nominations.*
2. *Election of Permanent Officers.*
3. *Report of Committee on Constitution and By-Laws.*
4. *Formal Ratification of Constitution and By-Laws.*
5. *Report of Committee on Plan and Scope.*

AFTERNOON SESSION

2 P.M. 1. *Report of Committee on Budget.*
2. *Report of Committee on Resolutions*

EVENING SESSION

8:30 P.M. 1. *Introductory remarks by the President of American Engineering Council.*
2. *Address by Herbert C. Hoover, President, A. I. M. E.*

9:30 P.M. *Informal Reception and Smoker.*

SATURDAY, NOV. 20, 1920.

9 A.M. *Organization Meeting of the Executive Board of American Engineering Council.*

PUBLICATIONS OF THE JOINT CONFERENCE COMMITTEE

Immediately following the Conference, the Joint Conference Committee prepared an abstract of the proceedings of the Organizing Conference in Washington, copies of which were mailed to each of the organizations originally invited to participate and to the technical papers. The Committee was instrumental in securing the co-operation of the technical press and through the courtesy of McGraw-Hill Company, Inc., published and distributed a sixty-four page booklet entitled "Engineers Unite," setting forth "The High Spots in the Washington Organizing Conference, June 3-4, 1920, as Reported and Interpreted by the Editors of the Technical Press," in the issues immediately following the Conference. The Committee issued a formal invitation to each organization, originally invited to the Organizing Conference, to become a Charter-Member of The Federated American Engineering Societies, and to appoint delegates to the first meeting of American Engineering Council to be held in November of this year.

The Joint Conference Committee also edited and published in pamphlet form, the Constitution and By-Laws of The Federated American Engineering Societies which have not only been distributed to the organizations invited to participate, but also to the technical press, and to others, and copies are available for general distribution

The Joint Conference Committee received communications from the participating organizations and others asking for interpretations of the constitution and by-laws, or for explanation of matters pertaining to the movement, and as it was of the opinion that

there were doubtless many others to whom the same information would be helpful therefore decided to issue bulletins contining the information requested, which would be available to the organizations invited to participate, as well as to the technical press. Nine bulletins have so far been issued. These bulletins first make announcement of Society action in the matter of membership in, and then answer mooted points in connection with, The Federated American Engineering Societies. Copies may be obtained by any engineering organization not already supplied, on request to The F. A. E. S., Engineering Societies Bldg., 29 W. 39th., New York.

Joint Conference Committee Organized by A. I. M. E. and Mining Congress

A conference called by Herbert Hoover, president of American Institute of Mining and Metallurgical Engineers, and comprising representatives appointed by the governing bodies of American Mining Congress and American Institute of Mining and Metallurgical Engineers, was held at the Engineers' Club, New York City, Monday evening, Sept. 13, 1920. Those present were Herbert Hoover, Bulkeley Wells, Edwin Ludlow, Walter Douglas, J. R. Finlay, B. B. Thayer, A. C. Morrison, E. P. Mathewson, Walter R. Ingalls, J. F. Callbreath and Bradley Stoughton.

The purpose of the conference was to formulate plans and establish a committee to co-ordinate the activities of the Mining Congress and the institute in respect of legislative work relating to the mining industry. As examples of work needing to be done were mentioned: The co-ordination of government work at Washington so as to place the appropriate work within the field of the United States Bureau of Mines the Geological Survey, and other bureaus relating to mining; the formulation of a revenue-producing tax which shall supply the deficiency resulting from the expected reduction in excess profit taxes; the maintenance of adequate statistical service to the mining industry; assistance to gold mining; making possible an appeal to the Court of Claims by claimants who fail to secure relief from the commission established by the Minerals Relief Bill.

By unanimous vote Herbert Hoover, James F. Callbreath, Bulkeley Wells and Bradley Stoughton were added to the conference committee.

The committee then organized by the unanimous election of Walter Douglas, chairman, and Bradley Stoughton, secretary, and on motion adopted the title "Joint Conference Committee of Mining Congress and Institute."

The joint conference committee is made up as follows: Walter Douglas, chairman, 99 John St., New York; Bradley Stoughton, secretary, 29 West 39th St., New York; James F. Callbreath, secretary American Mining Congress, Washington, D. C.; J. R. Finlay, 170 Broadway, New York; Herbert Hoover, 115 Broadway, New York; Walter Renton Ingalls, 115 Broadway, New York; Edwin Ludlow, 149 Broadway, New York; E. P. Mathewson, 42 Broadway, New York; A. C. Morrison, 30 East 42nd St., New York; Henry M. Payne, 50 Church St.; W. L. Saunders, 11 Broadway; J. E. Spurr, Tenth Ave. and Thirty-sixth St., New York; B. B. Thayer, 42 Broadway, New York; Bulkeley Wells, 201 14th St., Denver, Col., and care of H. Payne Whitney, 120 Broadway, New York; Daniel B. Wentz, Land Title Building, Philadelphia, Pa.

Labor Conditions in Central and South America Resemble Our Own

Analysis of Mental and Physical Conditions of Peoples by V. L. Havens—Cures Suggested Emphasize Engineers' Chance for Service

The Editor of *Ingeniería Internacional*, Verne L. Havens, has returned from a seven-months' trip through Panama, Peru, Chile, Argentina, Brazil, and the Windward Islands. Nearly everywhere he has found that, though each people believe their problems are peculiar to themselves and their locality, the reported troubles were always of the same nature.

The inhabitants throughout the Americas are in a highly nervous state, he finds. They are groping for new ideals and standards on which to base their lives. No doubt this is due to the excitement and emotions released by the war, and the remedy lies in the hands of the leaders, who should and must teach peace, co-operation, and calmness.

The second great fact is the actual shortage of labor, and specially of skilled men. The millions who have died by land and by sea, the more millions that today will not or can not work, are the cause of a world-wide deficit. For example, men are scarce in São Paulo, because those who in Europe formerly made cloth and pottery and leather for the Paulistas no longer do so. The Paulistas must and do make it for themselves; but those who make cloth cannot also build the railways, or plant coffee, or load ships. The resulting establishment of the small new industries at home has drawn men from other home labor, and they have not been replaced. Buenos Aires has now to furnish farm and ranch hands to the Argentine to replace Spanish and Italian "golondrinas" whose flying trips are at an end. They stay at home, or visit France, at harvest time.

The shortage of men and lack of production have forced up wages and prices. In general wages have risen 50 per cent throughout South America; but the number of working hours has decreased 20 per cent, and productivity has fallen to about 75 per cent of the standard of a few years ago. No doubt the latter is due, in part at least, to the general nervous tension. In the worst cases these conditions have combined to make the cost of production today 250 per cent of that of 1913.

Two Ways to Improve Conditions

Mr. Havens finds there are only two ways to improve this existing state of affairs. His first cure, which will require years for completion, is to train the boys of today to take the places of the skilled labor of yesterday. Much quicker help is promised by the second solution, the introduction of machinery wherever possible to reduce the labor of the men still working. This would include the greater development of waterpower, and stopping the unnecessary mining, transportation and burning of fuels.

Peru is perhaps the first South American country to recognize and act on the immediate necessity of sanitation as essential to the preservation of the children and the future manpower of the nation. At Paita the government has ordered the incineration of all but six houses to destroy the centers of infection there. Sanitation is no longer only a humane issue but has become a crucial national economic problem, and its neglect involves definite monetary loss to family, nation, and the world at large.

It is evident, that, as Mr. Havens remarks, "The work of the engineers of this generation will decide whether we are to progress or retrograde; and perhaps at no time in all the centuries to come will the engineers and industrial executives of all the Americas have the opportunity to build for the future, that lies before them today."

The Story of Petroleum

Bureau of Mines Offers a Very Complete Film Survey of the Oil Industry

A new four-reel motion picture film telling the story of petroleum has just been completed by the United States Bureau of Mines in co-operation with the Sinclair Consolidated Oil Corporation, and will be loaned for educational purposes to those desiring the same. Applications should be addressed to the Director, U. S. Bureau of Mines, Washington, D. C. In this film the entire story of the petroleum industry, including prospecting, production, refining, distribution and its ultimate uses, is shown in such a way as to be readily understood by the layman as well as the engineer student.

The Bureau of Mines has recently completed films showing various phases of the mining and metallurgical industry, and it is hoped that the borrowers of these films will treat them with the same care that has been taken in preparing them. Those requesting the loan of any films belonging to the Bureau of Mines are expected to pay the cost of postage both from the Washington office and return.

Technical Papers

Petroleum in Alabama—The most that can be said of Alabama as an oil-producing state is that prospects are promising. The "structures," so dear to the heart of the true oil man, are favorable in several parts of the commonwealth. The discoveries in Texas and Louisiana have caused many to wonder if the neighboring state of Alabama did not also have some petroleum possibilities, and the State Geological Survey (University, Ala.), has prepared Bulletin No. 22 (p. 230, free), which is a compilation of all existing information on the subject. The first forty pages form a very readable account of the manner in which oil occurs and how to go about finding it, information which is of general application.

Educating Miners — The number of mining employees in this country considerably exceeds a million, about 74 per cent of whom are engaged in coal mining. Mississippi is the only state in the Union in which the work of extracting minerals from the earth is not a recognized industry. The problem of educating mine employees is a branch of vocational education which is extremely important, and a thorough discussion of the subject is contained in "General Mining," Bulletin No. 38 (p. 168), issued by the Federal Board for Vocational Education, Washington, D. C., from which it may be obtained free of charge. All executives who seek increased efficiency of mine, mill, and smelter employees, and freedom from accidents will find much of interest in this book.

Electro-deposition — *The Mining Magazine* (London, price 1s. 6d.) published in its July and August issues a discussion of the late Prof. S. B. Christy's work on the electro-precipitation of gold and silver from cyanide solutions. The article is by J. E. Clennell, and occupies, in all, twelve pages.

Petroleum Research—A seven-page article in the Sept. 8 issue of *Chemical & Metallurgical Engineering*, by Martin J. Gavin, tells the story of the technical development of oil-shale retorting in Scotland and indicates the necessity of research work on domestic shales.

Talc—A new use for talc has been found as an ingredient in fire-resistant paint. A three-page mimeographed report on the subject is contained in the U. S. Bureau of Mines *Reports of Investigations* for August, Serial No. 2,150. (Free from the Bureau on request.)

Compressed Air Blasting—Rock which is easily split and in which joint planes are absent may be "blasted" with 100 lb. compressed air, inserted through a drill hole, after starting the fracture with a spoonful of black blasting powder. The method is explained in *Reports of Investigations*. Serial No. 2,154, issued by the U. S. Bureau of Mines, Washington, D. C. (Free.)

Petroleum—The A. I. M. E. (29 W. 39th St., New York, N. Y.) has published three papers to be presented at the September petroleum meeting of the Institute in St. Louis: "Petroleum Industry of Trinidad," by G. A. Macready; "Application of Taxation Regulations to Oil and Gas Properties," by Thomas Cox; and "Oil Shales and Petroleum Prospects in Brazil," by H. E. Williams. Brazil has enormous undeveloped oil resources in her areas of rich shales.

Gold and Silver.—"Gold and Silver in 1918" (pp. 60), a separate chapter of "Mineral Resources," has been issued by the U. S. Geological Survey.

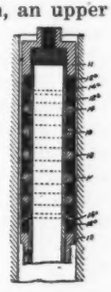
Iron in Europe—A discussion of the condition of the iron industry, a short description of the principal iron districts, and a tabulation of the iron-ore reserves in the new states of Europe are contained in a four-page article in the Sept. 9 *Iron Trade Review*. (Cleveland, Ohio; 25c.) Austria and Hungary have been shorn of their coal and iron resources, to the profit of Czecho-Slovakia.

Petroleum Bibliography—The U. S. Bureau of Mines is publishing periodically a list of recent important articles on petroleum and allied substances. It forms part of the *Reports of Investigations* series and may be obtained as issued upon request to the Bureau.

Recent Patents

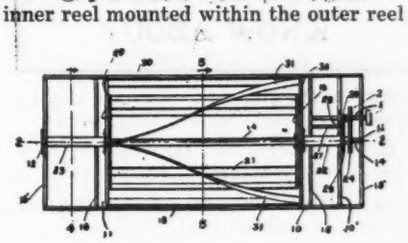
1,350,553. Oil-Well Packer. Patrick H. Mack, Bradford, Pa., assignor to Oil Well Supply Co., Pittsburgh, Pa. Filed Nov. 23, 1915.

In packing structures for wells, a tubular body member, opposing recessed end members carried thereon, an upper expansible member entered in one end member, a lower expansible member entered in the opposite end member, a series of expansible members intermediate the upper and lower expansible members, and a series of rigid members alternating with the intermediate expansible members.



1,350,509. Sand and Slime Separator. James D. McDonald, Hayden, Ariz. Filed Aug. 5, 1918.

In a slime and sand separator, the combination with a casing having an inlet at one end, a slime outlet at the other end, and a sand outlet at one side; of an outer reel rotatably mounted within the casing and having blades moving past said sand outlet, and an inner reel mounted within the outer reel



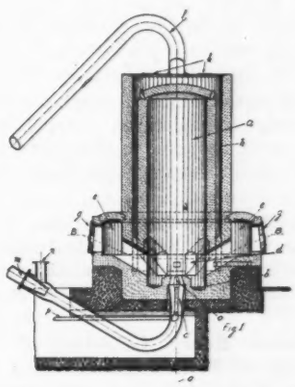
and rotating in the opposite direction, both reels having skeleton heads.

1,351,003. Well-Drilling Bit for Oil, Water, or Gas. Jefferson D. Pace, Shreveport, La., assignor to Acme Oil & Drill Co., Inc., Shreveport, La. Filed July 19, 1919.

In a well-drilling tool, a hollow drill rod, a coupling sleeve screwed upon the lower end of the drill rod, a block received within and screwed to the sleeve but spaced from the end of the drill rod, said block having a flared extension at its lower end, said extension having a circumferential series of slots, bits held upon the tool, said bits having beveled edges conforming to the flare of the extension, lateral extensions on each bit and adapted to fit said slots for holding the bits against longitudinal movement, said coupling sleeve being internally beveled to co-operate with the beveled edges of the bits to hold the bits in clamped position with their lateral extensions received within the slots.

1,315,551. Smelting of Ores in Suspension. F. H. F. Hampton, Sewell, Chile, assignor of one-half to W. W. Stenning, London, England. Filed March 30, 1916.

A smelting process which comprehends projecting a finely divided self-fluxing material upwardly into a zone sufficiently heated to cause the formation of melted slag; permitting the



melted globules to coalesce to form a bath of slag and valuable products, and causing all the gases to escape at the base only of said zone.

MEN YOU SHOULD KNOW ABOUT

Edwin Higgins has returned to San Francisco from Virginia City, Nev.

D. M. Liddell has returned to New York City from Joplin, Mo.

O. C. Davidson was on the Gogebic range the week of Sept. 13.

Messrs. Condit and **Howell** are working in northwestern India, and not in Idaho.

A. W. Newberry of New York City, is in Canada. He expects to return early in October.

A. E. Holmberg has joined the mechanical engineering staff of the McKinney Steel Co.

J. B. Umpleby, who is now doing oil geologic work in Oklahoma, is in the East on a business trip.

David G. Kerr and a party of friends and associates are on a vacation in the woods of northern Michigan.

E. C. Dyason, of Victoria, Australia, was recently re-elected president of the Chamber of Mines of Victoria.

C. M. Weld, mining engineer, has returned to New York City after an absence of two weeks in West Virginia.

Arnold Jere Noerager, chief electrical engineer of the Braden Copper Co., Rancagua, Chile, is in San Francisco, Cal.

Prof. Robert M. Raymond, of the Columbia University School of Mines is in Santa Fe, N. M., this week on private business.

C. W. Purington, mining engineer, left Hakodate, Japan, about Aug. 7, for an examination of the coal fields of northern Sakhalin.

B. C. Yates, superintendent for the Homestake Mining Co., at Lead, S. D., is in Denver attending the First Aid and Mine Rescue contests.

H. A. Jenison of the U. S. Geological Survey is in San Francisco. He is completing a trip through the copper producing sections of the West.

O. U. Bradley, oil and gas inspector on the lands of the Five Civilized Tribes, Oklahoma, was in Washington, D. C., at the end of August on official business.

J. C. Kinnear, smelter superintendent of Nevada Consolidated Copper Co., McGill, Nev., stopped in San Francisco recently on his return from Bully Hill, Cal.

W. P. Woodring has sailed for Haiti in charge of a U. S. Geological Survey party to continue geologic examination of the mountainous area of that republic.

Professor Henry Leighton, of the University of Pittsburgh, has been examining pyrite and iron ore deposits in northern Ontario for Pittsburgh interests.

C. J. Diebel, of Spokane, Wash., president of the United States Silver Lead Mines Co., has returned from inspecting the company's property in the Coeur d'Alenes.

Ira B. Joralemon, assistant general manager of the Calumet & Arizona Mining Co., Bisbee, Ariz., has been elected commander of the Bisbee American Legion post.

M. Poncet, mining engineer and a graduate of Saint-Etienne in 1902, was recently appointed chief engineer of the mining company of the Loire (la Société des Mines de la Loire).

Fred H. Moffit and **Herbert Insley** have completed the geologic work which they were doing on the west coast of Cook Inlet, Alaska, and are now working in the Copper River region.

L. C. Graton, geologist to the Calumet & Hecla Mining Co., of Calumet, Mich., is in Cambridge, Mass., temporarily. His address at present is: Foxcroft House, Oxford St., Cambridge, 38, Mass.

Julien Raick, recent graduate of Liege, Belgium, is studying the electrometallurgy of copper, zinc, and lead, at Leland Stanford, Jr. University. Mr. Raick is an exchange scholar of the Commission for Relief in Belgium.

H. C. Wang, vice-president of Chinese-American Industrial Corporation, Ltd., left New York on Sept. 16, and is returning to China by way of Montreal and Vancouver. He expects to sail from Vancouver on Sept. 24.

Wilbur A. Nelson, state geologist of Tennessee, has been conferring with War Department officials in connection with the survey which is to be made by the War Department of the resources of the upper Tennessee River basin.

Jacques Heuhgen, who recently graduated in geology from the School of Mines at Mons, Belgium, is spending a year in graduate study at Yale University under the exchange scholarship arrangements organized by the Commission for Relief in Belgium.

Dr. Francis B. Laney, of the United States Geological Survey has been appointed professor of geology in the University of Idaho School of Mines. Dr. Laney has done considerable work for the Geological Survey in co-operation with the Idaho Bureau of Mines and Geology.

G. F. Loughlin, head of the division of mineral resources of the U. S. Geological Survey has returned to Washington after having done some geologic work on the stratigraphy of the Narragansett basin. He also made some study of the igneous geology of the surrounding islands.

Lewis A. Parsons has severed his connection with the *Mining and Scientific Press* and is recuperating at El Paso, Texas. Mr. Parsons was formerly engineer of mines for the International Nickel Co. and also did some valuable work estimating the ore reserves of the Dome mines.

Alfred H. Brooks, who has been studying the general mineral situation in Alaska with the idea of advising the Secretary of the Interior as to the adoption of measures to stimulate the mining industry there, reached Ketchihan on Sept. 17 and will spend the remainder of the month examining the copper deposits near there.

Lapsley W. Hope, mining engineer, who has been superintendent for the Eureka-Holly Mining Co., Eureka, Nev., for the past three years, has resigned from that position. Mr. Hope took charge of the Eureka-Holly after four years spent operating mines in British Columbia, but first went to Eureka in 1912 when he was connected with the Credo-Eureka Mines Co. and later with the Adam Hill Corporation. His present address is Eureka, Nev.

OBITUARY

J. J. Welch, general manager of the Majuba Silver, Tin & Copper Co., Reno, Nev., died in San Francisco, Cal., on Sept. 10, following a major operation. Mr. Welch, who was in his sixtieth year, was long associated with the Gunn-Thompson interests.

Henry Berry, vice president and general manager of the Canadian Asbestos Co., died at Montreal Sept. 13 after a long illness at the age of 54 years. He had been engaged in the asbestos industry for many years, was a member of the Montreal Board of Trade and belonged to the Masonic Order. He leaves a widow and three sons.

SOCIETY MEETINGS ANNOUNCED

The American Electro Chemical Society meets at Cleveland, Ohio, Sept. 30 to Oct. 2.

Institute of Metals Division of A. I. M. E. will hold its customary joint sessions with the **American Foundrymen's Association** at Columbus, Ohio, during the week of Oct. 4. The technical sessions will probably be held on Tuesday, Wednesday and Thursday of that week.

Independent Oilmen's Association holds its 12th annual national convention, and a petroleum exposition at Denver, Col., Sept. 28 to Oct. 1. Headquarters will be at the New Albany Hotel and the sessions will be held in the Denver Auditorium Building.

California Metal & Mineral Producers Association will hold its regular annual meeting at its offices in the Merchants National Bank Building, San Francisco, Cal., on Oct. 27, 1920, at 10 o'clock a. m. The annual reports of the president, secretary-treasurer and engineer of the association will be submitted, three directors elected, and a special delegate elected to attend the annual convention of the American Mining Congress at Denver, Col., Nov. 15.

THE MINING NEWS

LEADING EVENTS

WEEKLY RÉSUMÉ

The hearing in the Minerals Separation-Miami Copper Co. flotation case that was to have been resumed on Sept. 15 before the master in Philadelphia has been postponed two weeks. Likewise the Federal Trade Commission has put off until Sept. 30 the inquiry into the conduct of Minerals Separation that was scheduled for Sept. 20 in Washington. In Colorado metal mine operators have conferred with the traffic agents of the various railroads in an effort to secure the re-establishment of the old freight rates on low-grade ores and concentrates. In the Coeur d'Alenes the Federal Mining & Smelting Co. has been denied a rehearing of the Star apex case. The Consolidated Virginia and other mines under Alex Wise on the Comstock lode in Nevada have given their men the $6 wage recently demanded.

At Butte the Anaconda and Davis Daly companies are reported each to claim a body of rich silver-zinc ore recently opened in the Nettie workings. The new tramway of the Walker Mining Co. at Portola, Cal., has been placed in commission. In Arizona the tax commission has cut the valuation of forty-three producing properties. The Swansea property is running again, this time under lease to Consolidated Arizona. During the week the petroleum section of the A.I.M.E. met in St. Louis.

Hearing in Miami Flotation Case Postponed

The hearing before the master in the Minerals Separation-Miami Copper Co. suit, which was to have been resumed on Sept. 15, has been deferred for two weeks. This was done in order that counsel may have opportunity to prepare the papers in an appeal which Minerals Separation, Ltd., has made, seeking to have the U. S. Circuit Court of Appeals, at Philadelphia, review Judge Morris' recent orders dismissing Minerals Separation's contempt proceedings. Minerals Separation sought by these proceedings to have the Miami company punished for contempt of court for continuing to use its present flotation process. Miami claims this is not the process described in any one of the patents of Minerals Separation.

Federal Appeal for Rehearing of Star Case Denied

The application of the Federal Mining & Smelting Co., of Wallace, Idaho, for a rehearing in the case of the Star Mining Co. against the Federal has been denied by the U. S. Court of Appeals at San Francisco. This was a case involving the apex of the Star-Morning (Federal) vein. The Federal won the case in the United States District Court for Idaho, from which the Star appealed to the appellate court and secured a reversal of the lower court. It is expected that the Federal company will now appeal for a writ of *certiorari*.

Ninety-Eight Teams Compete at Denver First Aid and Mine Rescue Meet

Homestake Mining Co.'s Team Takes Third Place in Mine Rescue Contest, All Other Prizes Going to Coal Teams—Several Mid-Year Conventions Held During Meeting

The International First Aid and Mine Rescue Meet, which convened in Denver, Col., September, 9, 10 and 11, was participated in by seventy-three first aid teams and twenty-five mine rescue teams, representing twenty different states of the Union.

The meeting was held under the auspices of the U. S. Bureau of Mines, co-operating with the American Red Cross, the Rocky Mountain Coal Mining Institute, the Colorado Metal Mining Association, the Colorado Chapter of the American Mining Congress, the Colorado, New Mexico and Utah Mine Operators Association and the Colorado Society of Engineers.

During the meet the Rocky Mountain Coal Mining Institute, the Colorado Society of Engineers, the Colorado Metal Mining Association and the Colorado Chapter of the American Mining Congress held their mid-year meetings, their sessions convening during the morning hours and the first aid and rescue contests taking place in the afternoon. Joint meetings of the various organizations were held on the evenings of Sept. 9 and 10.

The mine-rescue contest was conducted on the afternoon of Sept. 9, and was participated in by teams from Illinois, Indiana, New Mexico, Pennsylvania, South Dakota, Utah, Washington, West Virginia, Wyoming and Colorado. J. F. Bailey, assistant director of the U. S. Bureau of Mines, and J. D. Parker, chief of the division of safety cars and stations, were in charge.

In the mine rescue work a wooden gallery 50 ft. long, with straight runways, rock obstructions, falls and two pitches of 45 deg. was filled with formaldehyde and sulphur gas. Each rescue team consisting of four men and a captain, equipped with oxygen-breathing apparatus, worked out "problems" in this chamber.

In connection with the mine rescue program was a new feature, an airplane rescue stunt. Lieut. Kenneth L. Walker with his mechanic, Staff Sergeant Moore, flew from the U. S. Aviation Station at Ft. Sill, Okla., to take part in the event. An imitation mine entrance had been erected and at a signal Lieut. Kenneth L. Walker, in a De Haviland army plane, came swooping over the field with a member of the mine rescue squad. With the gallery filled with smoke, a mine rescue team penetrated the chamber and rescued the supposed victim of the explosion.

Assistant Director Bailey of the U. S. Bureau of Mines in speaking of the airplane as a factor in mine rescue work said:

"The wonderful development of the airplane within the last five years has been so rapid that though it has serious limitations, it is bound to become an important factor in rescue work. The time element is often the deciding factor in this work and airplanes are the fastest mode of travel known to-day. The greatest drawback to their use is the lack of suitable landing fields.

"A preliminary survey has indicated that airplane service might be effectively used in the flat-lying coal fields of Illinois and Indiana and a co-operative agreement has been made whereby McCook field, Dayton, Ohio, will maintain in readiness planes for assisting the bureau of mines safety station at Vincennes, Ind., in its rescue work."

Another feature of the meet was an explosion of coal dust which wrecked an artificial gallery from which the teams were supposed to rescue an entombed miner.

In addition to miners, mine inspectors and operators from practically every state in the country, there was in attendance from Pachuca, Mex., three underground safety inspectors from the Cia. de Real del Monte y Pachuca, and three others from the Cia. de Santa Gertrudis. These men were desirous of obtaining information as to methods in first-aid, mine rescue and general mine safety work and were furnished guides and interpreters by the Bureau of Mines during their stay in Denver.

There were entered a total of seventy-three first aid teams from twenty states, of which sixty-eight teams from eighteen states actually participated; in the mine rescue contests twenty-one teams from ten states entered, and seventeen teams from ten states actually competed.

First place in the first-aid contests went to the New River Company, Scarbro, W. Va., with Louis Roncaglione as captain, thus winning the silver cup donated by the National Safety Council, the silver cup donated by *Coal Age*, and still a third silver cup donated by the Coal Mining Institute of America, as well as numerous other prizes.

Second place in first aid work went to Team No. 1 (Captain James L. Bisch), St. Louis Rocky Mountain & Pacific Coal Co., Raton, N. Mex.; and third place to the DeBardeleben Coal Co., Sipsey, Ala., (Captain L. Shores).

First place in mine rescue work was won by the H. C. Frick Coal Co.'s team from its rescue station at Leisenring, Pa., (Captain S. Cominsky), taking a silver cup donated by *Coal Age*, a silver cup donated by the *Rocky Mountain News and Denver Times*, of Denver, a gold cup donated by *Coal Industry* of Pittsburgh, Pa., and several other prizes.

Second place in the mine rescue contests was won by the Wadge team of the Victor-American Fuel Co., Routt County, Col., (Robert Halbert, captain); and third place by the Homestake Mining Co., Lead, S. Dak., (L. B. Wright, captain).

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FRONT OF U. S. ASSAY OFFICE, WALL ST., NEW YORK, DAMAGED BY BOMB EXPLOSION OF SEPT. 16

The best combination standing of any team performing both first aid and mine rescue was made by the team from the Wadge mine (Robert Halbert, captain), of the Victor-American Fuel Co., Routt County, Col.

The silver cup donated by the Ironton Engine Co. for the best rating in first aid for teams from Rocky Mountain states (Colorado, New Mexico, Arizona, Utah, Wyoming, Montana, Idaho, North and South Dakota), was won by the St. Louis Rocky Mountain and Pacific Team No. 1 of Raton, N. Mex., (J. L. Bisch, captain).

Mining Association Discusses Ousting of Golden Station

More Space Needed for Students, Says Skinner, in Addressing Members—Committee Named To Assist Trustees

The action of the trustees of the Colorado School of Mines in refusing to extend the lease of the U. S. Bureau of Mines on the Engineering building at Golden, Col., which resulted in the removal of the Federal station from Colorado, came up for discussion at the meeting of the Colorado Metal Mining Association which concluded its session in Denver, Sept. 13.

Louis F. Skinner, president of the board of trustees of the School of Mines, addressed the meeting and stated that the action of the trustees in refusing to renew the lease was based upon the pressing requirements of the school for more room for the students. He stated that the attendance was increasing from year to year and that already they were crowded for suitable class rooms, and that with the increased attendance this year it was imperative that additional accommodations be provided. Other phases of the administration of the school were discussed at considerable length.

A committee was appointed consisting of Bulkeley Wells, of Telluride, George M. Taylor, of Colorado Springs, and three other members, to be appointed by the president of the Metal Mining Association, which was instructed to consult with the governor and trustees of the School of Mines and to tender to them the good offices of the Association in the upbuilding of the institution. The committee was instructed to make its investigations and report at the annual meeting of the Association which will be held early in January.

It is reported that samples of iron ore from a field near Onundar Fjordr, in the west of Iceland, which have been sent to Sweden for analysis, have been found to contain 70 per cent of iron of unusually good quality. A company is to be formed to carry on mining operations.

U. S. Assay Office Exterior Damaged in Wall Street Explosion

Powerful Bomb Kills Thirty-five at Noon Hour in Heart of Financial District

On Sept. 16, at three minutes after noon, when the financial district of New York was at its worst period of congestion, a bomb of great power exploded at Wall and Broad Streets, in front of the new building of the United States Assay Office and directly opposite the J. P. Morgan Building. Thirty-five people were killed and 200 to 300 injured. The remains of a horse and fragments of a truck point to the fact that the explosive was conveyed to the district by these means. Nothing has thus far been learned as to the perpetrators of the crime but that it is a Red outrage seems unquestionably accepted.

The Assay Office and the Morgan Building were badly damaged and many other buildings in the vicinity suffered heavily through broken windows. No one in the employ of the Assay Office was killed. The stone façade of the building is badly pitted from the force of the explosion and the windows damaged as seen in the accompanying photograph.

It was likewise at noon, on July 1, a little over a year ago, when the district was similarly congested, that the cornerstone of the new Assay Office was laid with fitting ceremony, William G. McAdoo and Carter Glass, Secretary of the Treasury, taking part. Five of the building's eight stories are below the street level and three of them above.

Chemists Discuss Potash Problems

At the recent meetings of the American Chemical Society at Chicago several important reports were presented by the division of fertilizer chemistry. Potash problems were discussed by two speakers. S. W. Parr, of the University of Illinois, described several potash shales of Illinois which were recommended as suitable for cement manufacture with potash by-product recovery. These shales having more than 5 per cent of K_2O would yield, if properly handled, over 5 lb. of potash per barrel of cement, equivalent to 70 or 80c. per barrel of by-product income.

H. A. Huston who has investigated the potash situation in Germany personally gave a full report on the situation. He says a complicated organization has resulted from the socialization of the industry. Labor is available in sufficient quantity but is very high. Transportation is difficult and very expensive. The fuel supply is short and costs are very high. This fuel situation has been particularly aggravated by the interruption of Silesian coal supplies by the fighting between the Poles and Reds. Incidentally the shortage of fuel has also resulted in the shortage of ammonium sulphate for fertilizer use.

The claim that discrimination had been made against the United States

purchasers of potash is believed contrary to the fact by Mr. Huston. He states that contrary to general belief there were no large stocks of potash available either at the end of 1918 nor at any time since then. There were certain portions of production reserved for the United States purchasers through the arrangement of the inter-allied agents who controlled these matters. However these agents were notified by someone that the United States did not need these supplies. They were, therefore, quickly disposed of elsewhere. As a consequence when purchasers from this country attempted to secure potash there was none available except at excessive prices. This has naturally led to the conclusion that the American purchaser was being discriminated against. Mr. Huston states, however, that the American purchaser has at all times been able to purchase as favorably as others who are in the market at the same time.

Special London Letter

BY W. A. DOMAN

London, Sept. 7—Embracing as it does world wide interests in mining, it is rather surprising that the department of the London Stock Exchange in which dealings in mining shares take place has remained so long neglected. In the main, of course, this is due to the fact that finance houses and speculative jobbers of the old-fashioned school are afraid to give a lead. The public would come along with support if it were convinced that any movement would continue, but after the experience of so many false starts, it has naturally become shy. Of course, partaking of a speculative character mining shares do not appeal to investors as a whole, despite the handsome dividends paid by many companies and the substantial profits that are made on dealing. Labor troubles have created a good deal of nervousness, and mining securities naturally feel the influence at once; they are the first to fall, and not always the earliest to recover. Whether we look at gold, silver, diamond, lead or tin descriptions conditions are to a certain extent the same, though causes are not in each case of an identical nature. Just at the moment there seems to be a rift in the labor clouds, and as the gold producing companies continue to realize a substantial premium upon their output the public is turning its attention to Kaffir shares again. Unfortunately, while the position of these companies has improved to a very remarkable extent in consequence of the gold premium, some mines being enabled to convert a loss into a surplus, it is not possible to make an effective comparison of outputs to-day with those of previous years.

Formerly the Rand production was given in fine ounces; now results look better in pounds sterling. It is regrettable from a statistical and comparative point of view, seeing that the Rand is the world's greatest goldfield. Output and profits are calculated upon gold at a certain price, though it is not clear that this price is the one at which the metal will be actually sold. It may be mentioned that this year the estimated price per oz. has been: January, £5. 7s. 6d.; February, £5. 10s.; March, £5. 5s.; April, £5. 2s. 6d.; May, £5. 5s.; June, £5. 2s. 6d.; July, £5. 5s.; August, £5. 12s. 6d. The New Modderfontein is still the world's premier producer and for August had an estimated working profit of £152,000 as compared with £135,000 in July. Similarly Government Areas report £140,000, or £6,000 more, and City Deep £73,000 for last month, an increase of £20,000. Prices of Kaffirs generally seem to be on the up grade again without much sign of activity. The influence of the gold premium can be seen in another way. The Globe and Phoenix, formerly the premier mine of Rhodesia, but now approaching its end unless additional orebodies can be discovered, has just declared a dividend of 1s. per share out of gold premium.

Diamond shares are affected by erratic movements in exchanges in the same way as certain Kaffirs shares in which free dealings take place on the Continent. De Beers Deferred are down to £19, purely on exchanges. The diamond trade has ruled quiet for some weeks, partly owing to over-speculation and partly owing to exchange vagaries. The intrinsic position, however, is perfectly sound. The Diamond Syndicate has outlined a policy from which they will not deviate; consequently, whether people buy diamonds now or later there will be no cheapening per carat. The tin world is still smarting from what is regarded as bad treatment on the part of the British government when dealing with the United States during the war, and fears are entertained that at present prices many Cornish mines cannot be profitably worked. Efforts are being made between Nigerian, Cornish, Far Eastern and Dutch interests to stabilize the price of tin.

National Mining Corporation shares were quoted during the week at *nil* to 1s. owing to a further call of 5s., making the shares 10s. paid. The Corporation is sound enough and exceptionally well managed, but has to develop its interests, the latest of which is a participation of 25,000 shares in British Equatorial Oil Corporation with a capital of £200,000 in £1 shares.

Although Utah is not a zinc producer of importance, its position as one of the far-western states producing this metal makes the recent rise in freight rates of importance particularly to small producers here, who for the most part ship to Kansas and Oklahoma. The Judge Mining & Smelting Co., of Park City is the largest producer of zinc in Utah treating its zinc ores, which are sulphide in its own electrolytic plant, but taking no custom ores.

Salt Lake Convention Discusses Mine Taxation

Committee's Report Presented by R. C. Allen—Paper Read by Paul Armitage

The National Tax Association, which began its annual convention in Salt Lake City on Sept. 6, held its closing meeting, consisting of a short business session at which officers were elected, on the evening of Sept. 10. Zenas W. Bliss, formerly governor of Rhode Island, and now chairman of the state board of tax commissioners of Rhode Island, was chosen president of the association, being succeeded as vice-president by Samuel Lord, of Minnesota. A. E. Holcomb was re-elected secretary and treasurer. William Bailey, secretary of the Utah board of equalization, was appointed a member of the committee on a model tax system, of which Prof. Chas. J. Bullock of Harvard is chairman.

The closing day was occupied with the subject of mine taxation, and the speeches were of especial interest in this community where mining is the chief industry. R. C. Allen, vice-president of the Lake Superior Iron Ore Association and chairman of the especial committee on mine taxation, presented the report of the committee, which was unanimous, being in favor of an *ad valorem* system of valuation of mines, it being held that such a method of valuation, although not easy to arrive at, was entirely practicable. Mines, it was stated, should be taxed according to the same system as other property, and not according to some system of multiple taxation, the actual value of a mine to be arrived at by taking into consideration all of the data available, including income.

A paper by Paul Armitage, attorney, and director of the United Verde Extension and a former chairman of the mine tax committee of the American Mining Congress, was read entitled "Income as a Factor in Mine Taxation," which discussed the various problems in determining what a mine's income really is. Stock prices were held to be deceptive, and the ability of an expert to fix valuation was strongly called into question, it being laid down that "the final and determinative factor in all mine taxation is the income received, and in using this for mine taxation, the principle that the base of all systems must be broad, not narrow, requires that the entire income, past, present, and future, be taken into consideration."

The Guyana Gold Placer Co., on whose estates in Suriname, Dutch Guiana, extensive iron-ore deposits are said to have been discovered at the Donderbariberg, now announces that manganese ore has been found in two places in the same field, accompanying ore in quartz veins. The ore occurs in the veins as a thin layer or as an irregular string between the quartz.

Gold Dredging Started at Dayton, Nev.

Operations of Gold Canyon Dredging Co. Begun With 9-Cu.Ft. Bucket Dredge on Alluvial Deposit — Governor's Wife Throws Switch in Presence of Two Thousand Onlookers

BY GEORGE J. YOUNG

About seventy years ago, prospectors and miners traveled on foot and packed their meager equipment upon horses. They scratched the surface and made their important discoveries but there were definite limits beyond which they could not go. On Sunday, Sept. 5, over three hundred "machines" brought over 2,000 people to a flat area just south of Silver City, Nev., near where the early miners had washed all the gold they could from the alluvial material filling the canyons and then had gone to other fields. The speed and promptness with which this assemblage was brought together reminds one of the way that Mark Twain brought his celestial audience together in describing Captain Eli Stormfield's adventures in heaven.

William Prouse is said to have been washing a milk can in the creek near Dayton when he discovered glistening particles of gold in 1850. He must have worn the conventional miner's costume of the period, which was very unconventional. If 2,000 miners of Prouse's time could have been assembled alongside of the 2,000 or more who patiently waited for the switch to be thrown that started the newly constructed dredge of the Gold Canyon Dredging Co., there would have been perhaps some mutual embarrassment, but on the whole there would have been two greatly astonished and amused groups of people. The group there on Sunday were dressed in their best. There were ladies present and silk gowns and smart hats. Only the legerdemain of modern times could have assembled such an audience in such a place. There was the same blue, cloudless sky, the bright sunshine, the brown hills thinly covered with silver-gray sagebrush that William Prouse looked upon in moments free from milk-can washing and gravel sluicing. The dredge occupied the center of the picture. It floated in a small pond at the head of an alluvial plain which sloped towards the distant Carson River. People swarmed all over it and walked around the pond. Throughout the excitement the 900-ton dredge maintained its equilibrium and waved its American flag.

After the public inspection the gangplank of the dredge was drawn up and used as a speaker's platform. R. H. Elliott, assistant general manager, represented Bulkeley Wells and was master of cermonies, being assisted by Gerald H. Hutton, engineer in charge of the dredge construction and operation. Edwin Higgins, staff engineer of the Metals Exploration Co., was the first speaker. He gave a brief sketch of the historical development of gold dredging and explained the operation of the dredge, also giving a brief summary of the features of the dredge which will be found in the last paragraph of this article. In concluding Mr. Higgins said:

"The men behind this organization are good sports. Their policy is human treatment of their men. The latest safety devices will protect the workers. This is a record job, completed in about four months of actual work. The conditions remind me of a stiff grade of a certain railroad in Arizona where to an old-timer listening to the laboring engines trying to make the grade the pistons seemed to say, 'It can't be done—it can't be done,' but when the moguls came along puffing upgrade the pistons sang, 'It's got to be done—it's got to be done,' and in a little while they would go over the top snorting, 'I knew I could do it—I knew I could do it.'"

President Clark of the Nevada State University, the next speaker, spoke of the mining industry of Nevada and of the advance made in mining engineering in relation to the University. Dr. Aurelia Rhinehart, president of Mills College, captivated the audience by a witty address in which, among other things, she pointed out that women had a considerable interest in an enterprise like gold dredging because the greater part of the gold of the country is spent by women. Governor Emmet D. Boyle concluded the addresses by describing the part played by the engineer in developing natural resources and making the production of metals a profitable business. He pointed out the relation of both capital and labor in initiating enterprise.

DREDGE STARTED BY MRS. EMMET D. BOYLE

The dredge crew, as soon as the speakers were out of the way, went to their stations and Mrs. Emmet D. Boyle started the dredge in operation. The people swarmed around and took even greater interest in watching the wheels go around than they did in getting acquainted with the motionless machine before. The dredge crew had a hard task to keep the enthusiastic spectators out of the machinery, but everything went well and afterwards all departed homewards in clouds of dust and the roar of many machines, happy in the thought that they had participated in the historic event.

The dredge was constructed by the Bethlehem Shipbuilding Corporation, the dredging department of which corporation is managed by George L. Hurst. The hull is 108 ft. long, 52 ft. wide and 8 ft. deep. It is built of steel, the main deck being of welded steel plates $\frac{7}{16}$ in. thick. The well-hole plates are $\frac{1}{2}$ in. thick, and extend through the length of the dredge, giving great stiffness to the hull. All of the framing of the superstructure is steel. The digging ladder weighs 55 tons and is equipped with 9 cu.ft. manganese steel buckets, each weighing 2,500 lb. The speed is 20 buckets per min. The steel spuds are 55 ft. long, are built of steel I beams and weigh 20 tons each. The buckets discharge into a receiving hopper and this in turn to the revolving screen 6 ft. in diameter by 38 ft. long, revolving at 15 r.p.m. and provided with $\frac{1}{2}$-in. round holes. The stacker is equipped with a 34-in. conveyor belt, 120 ft. long. The stacking height is 30 ft., the digging depth 40 ft. and the arc of swing 175 ft. approximately. The sluice and riffle area is 3,000 sq.ft. The principal water supply is provided by a 10-in. centrifugal pump, the pressure water being under an 80-ft. head. The electric motors aggregate 500 hp. and work at 440 volts. The power line receives current at 22,000 v. from the line of the Truckee River General Electric Co. This voltage is stepped down to 4,400 and then to 440 volts. The total weight of the dredge is 900 tons. The material for it was transported to the building site by motor trucks from Dayton and erected in about four months working time. Its capacity is 5,000 cu.ft. per day. The proved dredging area is 200 acres with the possibility of further extension. It is expected that five years operation is assured. The investment is reported to be approximately $350,000.

Colorado Operators Want Old Rate on Low-Grade Ores and Concentrates

Meet Traffic Agents of Ore-Carrying Roads—Industry in State in Critical Condition, It is Claimed

At the request of the Colorado Metal Mining Association, a joint meeting of the traffic agents of railroads serving Colorado metal mining districts convened with mine operators in Denver, Sept. 13, to consider conditions brought about by the recent increase in freight rates, as authorized by the Interstate Commerce Commission.

Colorado operators assert that this increase, if maintained, will result in the closing down of at least 50 per cent of the mines now operating. The increase means an average boost in production costs of smelting grades of ore of more than $1 per ton, in addition to the 50c. advance in smelting charges announced by the smelters. On concentrates the advance in many instances absorbs the small margin of profit in milling the lower grades of ore, and several of the largest milling plants in the state, according to the management, will close down unless relief is afforded.

Operators assert that the metal mining industry in Colorado is in a critical condition and that the old freight rates were, in many instances, more than the industry could bear and that the present increase means absolute disaster. They contend that the increase in rates

will not only fail to increase the revenue of the railroads but will actually reduce receipts, as there will be much less ore to handle and a corresponding decrease in incoming freight to mining camps. They ask that the old rate be restored on low-grade ores and concentrates.

They point to the fact that during the first half of 1919 the smelters treated 194,031 tons of ore and concentrates as against 152,496 tons for the first half of 1920, and assert that any further increase in operating costs will result in a much larger falling off of production for the last half of 1920.

At the meeting, the foundation was laid for an appeal to the Interstate Commerce Commission for a readjustment of rates on interstate shipments. The 35 per cent increase in these rates has stopped all shipments of manganese ores from Colorado as well as absorbed practically all profit in producing zinc bearing ores or concentrates. The advance in bullion rates also seriously affects the industry and a determined effort will be made, in co-operation with the shippers in other mining states, to secure a readjustment of bullion rates.

At the conclusion of the hearing, the carriers announced that the appeal of the shippers would be taken under advisement and that a decision would be announced within a very short time. It is believed that very substantial relief will be granted.

Recent Production Reports

Cie. du Boleo, Santa Rosalia, Baja California, produced 618,390 lb. copper in August against 781,613 in July.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Government Smelter for Alaska Not Favored

Present Situation Being Studied by Survey and Bureau of Mines—Anyox Plant a Factor

There is an insistent demand in Alaska for a Government smelter. Although officials in Washington are lending no encouragement to the idea of the Government entering the smelting business they are receiving the plea sympathetically as they recognize it as the outgrowth of a very unsatisfactory situation in the territory. Since they do not favor a Government smelter they they hope to be able to offer some constructive alternative suggestion.

The most thorough study that ever has been made of the smelter situation in Alaska is now in progress. The work is being done by A. H. Brooks, of the U. S. Geological Survey, and O. C. Ralston, of the U. S. Bureau of Mines. Among other things they will report as to whether or not the policies of larger interests in Alaska handicap in any way the smelting of ores of the smaller producers. There is a custom smelter at Anyox, B. C., just below the Alaskan boundary. It is on tidewater and apparently is well adapted to the handling of Alaska ores. The smelter is not being operated to capacity. That situation also is to be reported on.

Anaconda To Start Making Fertilizer Soon

The Anaconda Copper Mining Co., the Bureau of Mines is informed, expects to begin quantitative production of a super-phosphate fertilizer in the near future. The company intends to enter actively into competition for a fertilizer market in the middle west. By manufacturing a fertilizer containing 48 per cent of the available phosphoric acid, the company's engineers are of the opinion that the high transportation charge can be absorbed and still be able to compete with the eastern-made fertilizers, most of which contain 16 per cent of available phosphoric acid.

Complex Ores of Nevada Studied by Bureau of Mines

Experimenting on Yellow Pine Ores Since February—Also on Ruby Hill Ores

In view of statements to the effect that research on the complex and oxidized ores of Nevada is being neglected the U. S. Bureau of Mines calls attention to the work which is now in progress on these ores. Experiments are being conducted on two kinds of ores which are being obtained from Goodsprings and Eureka, Nev., respectively. The work on the Goodsprings ore has been in progress for a year. Several months will elapse before a final report can be made on that work. It can be said, however, that the work is being conducted under a co-operative agreement with the Yellow Pine Mining Co. The ores contain approximately 5 per cent lead, 5 oz. of silver and 38 per cent zinc. The lead and silver content of the 1,500 to 1,800 tons that is shipped monthly is being lost. The object of the experiments has been to volatilize the lead and silver from the zinc and to raise the grade of zinc. Thus far in the experiments it has been possible to recover in excess of 90 per cent of the silver and lead with a small zinc loss.

The work has been in progress almost continually since February. Tests are being conducted in a fifty-foot kiln. The experiments have been sufficiently encouraging to the company so that it is anxious to put in a commercial plant to carry on the method of treatment.

Work on the ores containing gold, silver, lead and copper, mostly of the oxidized variety, has been in progress for six months. This work has been in co-operation with the Ruby Hill Development Co. High extractions have been obtained from the methods employed in these experiments. Some of the work has been done on a large scale. One of the more recent tests was run on a 3,000 lb. lot. The results obtained from such tests are more to be relied upon.

Arizona Smoke Farmers Appeal to Bureau of Mines

Latter Willing To Co-operate Where Both Parties to Dispute Request It

Vigorous claims are being made by farmers in the Verde Valley in Arizona that their crops are being damaged by smelter smoke. The U. S. Bureau of Mines has been requested to advise how relief can be obtained. In reply, Dr. F. G. Cottrell, the director of the Bureau, has explained that his Bureau has no authority to take the initiative in smelter smoke cases, but that it has co-operated in technical investigations on smelter smoke difficulties where each party to the controversy requests the Bureau's co-operation. Attention was called to the fact that since crop damage is caused largely by sulphur dioxide (compared wih other gases), which is not recoverable by electrical precipitation or baghouse installations, the only effective solution is the use of the sulphur dioxide in the manufacture of sulphur acid, as is being done at Copper Hill, Tenn., by the Tennessee Copper Co. It was pointed out that this is not feasible unless the sulphuric acid can be utilized. It cannot be discharged on the ground or in the streams, even if the companies would stand the expense of its manufacture without having a market for the product. Very high stacks also may decrease the smoke nuisance.

Products of mines to the extent of 143,323,954 tons were carried on the Class 1 railroads for the three months ended March 31, 1920. Class 1 roads are those having annual operating revenues above $1,000,000. Bituminous coal occupied first place with 90,600,000 tons, in round figures. Anthracite coal ranked next with 17,300,000 tons. Clay, gravels, sand and stone, which are classed together, came next with a total of 15,700,000 tons. Iron ore furnished 3,200,000 tons of revenue producing freight while all other ores and concentrates produced practically the same tonnage. Base bullion and matte provided 195,000 tons of freight.

NEWS BY MINING DISTRICTS

MEXICO

Big Increase in Mine Taxes Collected Expected This Year

Mexico City—The secretary of the department of commerce and labor of Mexico has recently issued some interesting figures on the mining and metal industry of the Republic. According to his statement, there are 60,569 mining claims now under title of which less than half, or 30,990, are in arrears with their taxes and subject to default. Of these properties 3,868 are actually being worked at this time.

The government collected from direct taxes on mines last year only 1,891,467.66 pesos due to the fact that conditions throughout the country kept most of the mine owners either out of the country or away from their properties. A big increase will be shown for this year. Aside from the direct *pertenencia* (claim) tax, the government got 11,988,329.22 pesos out of the miners as a metal tax, which income will likewise be greatly swelled for the year 1920.

Of the sixty odd thousand mining properties now on the books only 2,017 date further back than 1892.

The Alvarado Mining & Milling Co., operating in the Parral district, Chihuahua, has asked for *amparo* in the suit which has been pending for sometime over the Elvira claim, which was denounced sometime ago and patent issued by the secretary of commerce and Industry. The Alvarado people claim the Elvira as one of their properties of long standing. In a previous denouncement, the Alvarado people won their suit but a second time the matter has come up and the parties contesting the title of the Alvarado company have begun to drive a tunnel into the Elvira, backed by a specific permit from the mining authorities at Mexico City. A suspension has been granted by the local courts and work on the disputed property must be held up until the ownership is definitely decided.

CANADA

British Columbia

Litigation Over Molybdenum Properties at Alice Arm Before Victoria Court

Victoria — There is now before the Supreme Court, Victoria, B. C., an action involving title to molybdenum properties of Alice Arm, B. C. The suit is brought by Robert M. Stewart, manager of the Stewart Land Co., of Victoria, and the defendants are the Molybdenum Mining Co. H. A. McLean, counsel for the latter, in his summing up of the situation, explained that the purpose practically was to obtain judgment as to the ownership of the property.

Stewart—It is reported that the present bondholders of the Big Missouri Group, Salmon River, Portland Canal district, do not intend to continue development work. Operations have been under way for some time by a syndicate known as the Pacific Coast Exploration Co. prominently identified with which is Sir Donald Mann, of Toronto, Ont. Both diamond drills with which exploration work has been in progress have been withdrawn. The only information made public, and it is unofficial, is that the Big Missouri presents an unusual problem, that the small amount of drilling done has not given satisfactory results, and that the complete exploration of the entire mineralized zone is a work of such magnitude that the company does not feel disposed at present to continue.

Alice Arm—There now are 230 men employed at the Dolly Varden mine, on the Kitsault River, and the output of ore for July totalled 5,600 tons, all of which was sent to Anyox, In addition a quantity of high-grade ore was forwarded direct to the Tacoma smelter. The force indicated has been divided during the summer equally between the mine and the railroad and if the snow of the coming winter makes the continued operation of the railway impossible, only about 65 men will be kept on, and that on development work. At present power for the air compressors is secured from oil engines but a hydro-electric plant is being installed on the Wolf claims which will be used for all purposes. It will be capable of providing 500-hp. for operating a 12-drill compressor. The Wolf, which is situated three miles up the river from the Dolly Varden, is reported to have given gratifying indications in diamond drilling, and tunnelling is to be started without delay.

Trail—Ore shipments received at the Consolidated smelter during the week ended Sept. 7 totaled 7,718 tons, from the following shippers:

Mine	Location	Gross Tons
Emerald,	Salmo	45
Josie,	Rossland	170
Mandy,	The Pas	371
North Star,	Kimberley	125
Nettie L.,	Gerrard	18
Payne,	Sandon	9
Taltapin,	Taltapin	4
Velvet,	Velvet	27
Company mines		6,949

Yukon Territory

Dawson—The placer camps of the Yukon Valley, it is estimated, will yield $4,485,000 for the season of 1920. Practically every camp in the North suffered a heavy decline for the reason that it has been a very dry season. Hydraulic operations consequently have been much curtailed. Yields by camps of the interior of Alaska and the Yukon for the season drawing to a close are estimated by competent authorities as follows: Dawson, $1,500,000; Fairbanks, $750,000; Tolovana, $750,000; Iditarod, $500,000; Tacotna and Ophir, $500,000; Hot Springs, $100,000; Ruby, $100,000; Koyukuk, $75,000; Circle, $70,000; Marshall, $50,000; Forty Mile, $50,000; Rampart, $20,000; Chandler, $20,000. Total, $4,485,000. In commenting on the situation thus disclosed, the Dawson *Daily News* observes that if the decline in gold production is to be arrested, it will be necessary to restore the purchasing power of gold by bonus or otherwise as low grade alluvial gravel cannot be worked under present conditions.

Ontario

Labor More Abundant—Excavation for Ontario-Kirkland Mill Started

Labor conditions in the Northern Ontario mining camps are beginning to improve. During the summer many laborers were attracted by the high wages paid by the automobile manufacturers in Detroit and Windsor, and later on the call of the West for harvesters was answered by many employed in the mines. The latter are returning in considerable numbers and the dullness in the automobile industry has resulted in a movement back to the mines, which is likely to increase very shortly. Many Italians, who left as soon as the war was over, are said to have written asking for jobs and a large influx from that country is anticipated.

Kirkland Lake—Excavating for the new 100-ton mill of the Ontario Kirkland has been started. The heavy equipment will be brought in over the winter roads for installation early in the spring.

The Lake Shore main shaft is being sunk to 800 ft. and conditions on the property are very satisfactory.

The final payment on the Murray Mogridge property has been met, and title to the property is now vested in the company. It is expected that extensive development work will be done.

The Thackery Mines have recently acquired two new properties, a gold prospect in the township of Lebel, and a silver prospect in Elk Lake.

Cobalt — The McDonald Syndicate, which has a lease on the Ruby Silver Mines, is making regular shipments of high-grade mill rock to the mining corporation.

Porcupine—The 84 vein of the Hollinger has been caught on the McIntyre by diamond drills below the 1,000-ft. level. This vein system is one of the most important on the Hollinger and will mean a great deal to the McIntyre. The values as shown by the drills are higher than the average of McIntyre ore.

ALASKA

Water Shortage in Interior Curtails Placer Output

Seattle—The production of placer gold in the interior camps of Alaska has been curtailed by the shortage of water with which to carry on sluicing operations, according to Volney Richmond, general manager of the Northern Commercial Co., who has just completed an inspection tour of the interior. This condition has been brought about by the unusually light precipitation. Dredges operated this season in the Iditarod, Ophir-Tacotna and Fairbanks districts but the Berry dredges in the Circle district have been shut down all season. In the Kantishna two big hydraulic plants have been installed, one by the Mount McKinley Gold Placers Co. and another by Fairbanks capital. Mr. Richmond estimated the total gold production for interior Alaska this year at $2,985,000, and the total for Dawson district at $1,500,000.

Considerable activity in lode mining is anticipated for the winter months. The Alaska Endicott Mining Co. will carry on active development work at their Windham Bay property according to Charles W. Mason, president, who has just returned to Seattle from a tour of inspection. Mr. Mason states that 3,000 ft. of development work has been completed to date and a five-stamp mill is now running on the tailings. The company expect to finish 4,500 ft. of pipe line and also a tram line to connect the mine and mill. Machinery for a 30-stamp mill is now on the ground and will be erected in the spring.

The Crystal Group at Snettisham are operating a five-stamp mill. The Chichagof Mining Co. is preparing to install a stamp mill on the Lisianski Group next spring. A considerable amount of underground development work has been completed on this property. The Admiralty Gold Mining Co. in the Funter Bay section has also been carrying on development work during the summer months.

CALIFORNIA

New Walker Tramway in Commission —New Level Opened by Plymouth Con

Portola—The Walker Copper Co., a subsidiary of Anaconda, has completed the aerial tramway to Spring Garden and is using it to ship its concentrates to the railroad station. The tramway eliminates the motor trucks formerly used.

The Gruss copper mine has developed several new and important orebodies and the management reports that in the next few months the mine will be firmly placed on a dividend paying basis. The mill continues to work on ore formerly blocked out. Assays of concentrates two weeks ago assayed as high as $250, with none lower than $232 per ton.

Sutter Creek—The South Eureka has installed additional pumping equipment and other improvements have been made by the Central Eureka company. Under an agreement made several months ago the Central Eureka is keeping both its own mine and the South Eureka free from water. Lack of electric power is hampering operation of the pumps and the mill is limited to half its capacity every sixteen hours of each day.

Plymouth—Profitable operations continue at the Plymouth Consolidated, near Plymouth, and at the Carson Hill, at Melones, according to the report recently made by the Loring Syndicate. A new level has just been opened in the Plymouth and the extension of the orebody uncovered. The Carson Hill group is now yielding excellent ore.

Oroville — The Cherokee hydraulic mine, in the Table Mountain district, plans to resume operations. The Cherokee formerly ranked among the largest hydraulic gold producers in California and under the new management a series of crosscuts will be driven to reach the channel believed to run under Table Mountain.

MILL AND TAILINGS POND AT ANACONDA COPPER MINING CO.'S WALKER MINE, PORTOLA, CAL. TRAMWAY TO UPPER MINE IS SEEN IN CENTER. SNOW SHED ON RIGHT BEYOND MILL LEADS TO LOWER TUNNEL.

NEVADA

Comstock Miners Get Wage Advance— Machinery Company Sues Gold Pen Mines Co.

Rand—The Western Machinery & Engineering Co., of Reno, has started suit against the Gold Pen Mines Co., alleging that machinery bought is not paid for.

Virginia City—The 250-hp. electric hoist which the Goldfield Consolidated had at its Clermont shaft has been bought by the Con. Virginia to replace its steam hoist. The Con. Virginia and the other Comstock mines under Alex Wise have met the demands of the miners for a $6 per day wage.

Tonopah—The latest bullion shipments from the Tonopah district, representing about fifteen days operations in the Tonopah Belmont and West End mines were $86,000 and $60,000 respectively. Regular development and production at the principal mines are reported with no important changes. Construction work at the Belmont milling plant in Millers is progressing, the plant being remodeled to treat the accumulated tailings at that point. In the North Star mine a discovery of promise has been made on the 1,050 level which may be the downward continuation of the rich orebody discovered on the 950 level in 1912. The ore was worked both below and above the 950 level but became low grade on the 1,050 where worked. The vein at present shows a width of 5 ft., all of which is ore of excellent grade.

Divide—In the Tonopah Divide mine good progress is being made in cutting the station on the 1,000 level preparatory to crosscutting. Values and widths are holding out well in development faces on the upper levels and the future appears bright. The Gold Zone and Brougher Divide both report continued development in ore of milling grade. The management of the East Divide and Alto Divide have announced that operations will be resumed at once.

Broken Hills—Official announcement from the Broken Hills mine states that the shaft at 225 ft. depth shows the vein to be 8 ft. wide and to contain ore of good grade. The vein in the south drift on the 150 level is 4 ft. wide and the ore of good grade, two feet averaging over $100 per ton. On the 80-ft. level the east drift on the Belmont veir shows two feet of high-grade ore.

Pioche—All ore shipments from the Pioche district are billed on the increased freight rate schedule which went into effect on Aug. 26. The shipments for the week ended Sept. 9 were as follows: Prince Consolidated, 1,950 tons; Virginia Louis, 350 tons; Bristol Silver Mines, 150 tons; Black Metals, 150 tons; Combined Metals, 100 tons; Ida May, 40 tons; total, 2,740 tons.

The Bristol Silver Mines Co. operating the Tempest, Hillside, Gypsy, May Day, Great Eastern and National Territory, are producing a large tonnage of silver-lead-copper ore, this ore being carried over Bristol Mountain by aerial tramway to the terminal bins at the Jackrabbit, whence it passes over the Pioche Pacific Ry., a distance of fourteen miles, to connect with the Salt Lake Route at Pioche.

Last month over 1,000 tons of ore was shipped to the Salt Lake smelters. The average analysis of this tonnage was 0.02 oz. gold; 23.2 oz. silver; 12.5 per cent lead; 3.3 per cent copper; 6.7 per cent zinc; 10.5 per cent iron; 23.5 per cent insoluble; 1.7 per cent manganese; 10.2 per cent lime, and 1 per cent sulphur, making a most desirable smelting product and bringing a handsome profit to the company.

This ore is being mined principally from the Lloyd Bent winze, which is situated about 200 ft. in a southerly direction from the Gypsy shaft, and about 800 ft. from the surface. The Lloyd-Bent winze was originally sunk to develop the Gypsy ore shoot, the famous orebody from which W. M. Christian, John R. Cook and the late William Lloyd took out a small fortune during their short lease in 1905.

At a later period the Uvada Copper Co. followed the ore down and made a satisfactory production from this section of the mine. At the time when the Bristol company started operations, examination disclosed the presence of good ore in the bottom of this winze, and since then the winze has been sunk to a point 800 ft. from the surface. At this depth a station has been cut and laterals will be run to prove up the extent of the orebody. The ore is soft and easily mined.

The management plans, in the near future, to improve the accommodations at the mine, and the boarding house will be enlarged and renovated. Twenty-five men are at present employed and it now seems certain that the former wonderful production by the Bristol mines will be materially added to in the future.

ARIZONA

Tax Commission Cuts Valuation of Forty-three Producers—Swansea Again Running

Phoenix—Mining circles are stirred at present by the situation resulting from the suspension of assessment work requirements during the war. It is expected that many claims will lapse and that there will be much trouble over re-locations. During the last three years many claims have been located by prospectors and miners who have done practically no work, hoping to sell before the usual Governmental demands again might be enforced. Individuals are known to hold over 100 claims in a single name. Naturally, there can be no fulfillment of the assessment requirements in such cases. Another class, including men of means who really want to comply with the law, are now finding it almost impossible to get miners, or even laborers, to do the necessary work, even at wages higher than ordinarily paid.

The State Tax Commission has cut down by $25,000,000 the valuation of forty-three Arizona producing mines, not including reduction works. The gross assessment on producing mines has been dropped from $414,236,000 in 1919 to $329,030,000. This has been done in consideration of the fact that the mines are working at only 35 to 60 per cent of normal and upon the relatively low price of the output, much of it unsold at this time. United Verde's valuation has been dropped about $3,000,000, Extension about $2,000,000, Miami over $4,000,000, Inspiration, $8,000,000, New Cornelia, $4,000,000. Copper Queen was raised about $2,000,000, to $65,394,000, thus taking place as the mine of highest assessment, somewhat overtopping Inspiration, which has been leader in the last few years. Calumet & Arizona also was raised the same amount to $42,163,000.

Bouse—Swansea is again in operation, shipping fluxing ores to the Humboldt smelter at the rate of 70 tons a day. The property is under lease to the Consolidated Arizona Smelting Co. of Humboldt and is being operated largely by Mexican labor. The Clark lease latterly found little or no profit in operating the new mill.

NEW MEXICO

Lordsburg—Ore shipments from this district for August amounted to 79 cars or 4,369 tons, of an approximate value of $87,000. The bulk of this ore went to the C. & A. smelter at Douglas, Ariz.

UTAH

Park City—Shipments of ore and concentrates for the week ended Sept. 11 amounted to 1,722 tons: Silver King Coalition shipped 636 tons; Judge M. & S., 429; Ontario, 333; Daly West, 115; Daly, 111; Naildriver, 50; and J. B. Ireland, leasing on Scott Hill, 38. In general, operations at the camp are hampered by lack of labor.

Eureka—Tintic shipments for the week ended Sept. 10 amounted to 142 cars.

MONTANA

Anaconda and Davis-Daly in Dispute Over Promising Ore in Nettie Workings

Butte—A large body of silver-zinc ore has been opened in what are known as the Nettie workings, but under the surface of the Horseshoe claim, adjoining the Hibernia mine of the Davis-Daly. Anaconda is laying claim to the orebody. Davis-Daly is endeavoring to prove an apex. This orebody shows for a width of ten posts, all of milling grade with the exception of 30 ft. which is sulphide ore without any waste.

Several days time were lost recently at the Black Rock mine in consequence of an air explosion in the engine room.

WASHINGTON

Zinc Ore Discovered Near Northport Proves Interesting

Northport—During April, 1920, a deposit of smithsonite was uncovered on land owned by Gust Maki, a rancher, six miles east of Northport, Stevens County, Wash. It was purchased by John Gorien, of Minneapolis. By August, 1920, six cars of ore averaging 40 per cent zinc had been shipped to Wisconsin for treatment. The deposit, which occurs along a shear zone through limestone, has been explored for 90 ft. along the strike and 100 ft. vertically. The ore is crystallized zinc carbonates with only minor amounts of the sulphides so far present. The orebody will no doubt prove of limited size but it can be expected to develop a reasonably good tonnage of shipping ore. The property is situated in an active mining district but 100 ft. from a well travelled road. Its earlier discovery was prevented by the fact that the outcrop was masked by considerable hillside wash.

MICHIGAN

Gogebic Range

Ironton Mine's New Hoisting Plant in Operation

Bessemer—The new hoisting plant at the Winona shaft of the Ironton mine has been put into operation, but has not as yet been tested with full loads. The two Nordberg hoists each have two drums 10 ft. in dia. by 72 in. face clutched to the shaft, and have rope capacities of 4,500 ft. of 1⅛-in. rope wound in three layers. The cage hoist is driven by a 400-hp. induction motor with herringbone gears, and the ore hoist is direct-connected to a 1,650-hp. 525-volt d.c. motor with a rated speed of 80 r.p.m., which gives a rope speed of about 2,500 ft. per min. The flywheel-motor-generator set which carries the peak of the ore hoisting load runs at 514 to 505 r.p.m. So far the installation is giving satisfaction, but until the regular ropes come and the hoists are operated under full load and speed their real performance can not be determined.

Ironwood—Erection of towers on the Pabst-Davis-Puritan transmission line has been started. There will be over thirty steel towers in the line varying in height from 40 to 80 ft.

The Copper District

Calumet—The Seneca shaft has now reached a depth of 2,223 ft. and laterals have been driven 2,722 ft. from the 1st to the 4th levels. It is estimated that 361,000 tons of shipping rock is ready for mining. When the present development campaign is completed (about April 1, 1921) the shaft will have reached the 8th level at 2,640 ft. with a total of 7,961 ft. of lateral stope drifts from the 1st to the 6th level. The tonnage of rock that will be ready for stoping then is estimated at something over 1,100,000.

THE MARKET REPORT

Daily Prices of Metals in New York

Sept.	Copper	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
16	18.10@18.35	42.25	44.75@45.00	8.30	8.00@8.40	7.65@7.70
17	17.95@18.35	42.25	44.50@44.75	8.15	8.00@8.25	7.65
18	17.95@18.35	42.25	44.75@45.00	8.00	7.75@8.25	7.65
20	17.95@18.35	42.50	44.75@45.00	7.90	7.75@8.25	7.65
21	17.95@18.35	42.00	44.00@44.50	7.85	7.50@8.25	7.65
22	17.95@18.35	41.75	44.00@44.25	7.75	7.50@8.10	7.65

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point. All prices are in cents per pound.

Copper is commonly sold on terms "delivered," which means that the seller pays the freight from refinery to buyer's destination. The delivery cost varies, and it would be confusing to figure net prices on individual transactions. Consequently, an average deduction of 0.15c. is made from the "delivered" price, to arrive at the New York price. When copper is sold f.o.b. or f.a.s. New York, of course no deduction is made.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
16	99½	99¼	112	274¾	279½	35	35	39½	40½
17	99⅛	98⅞	112	277	281½	35¾	35¾	39⅝	40⅞
18	....	....	...	....	....	...	...	...	...
20	98	98	112	275	279½	35½	35½	40	41⅛
21	97	97	112	272¾	278	35⅜	35½	40¾	41⅝
22	97	97½	112	269¾	275½	34⅞	34⅞	40¾	41¾

The above table gives the closing quotations on the London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Sept.	Sterling Exchange	Silver			Sept.	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
16	348	99½	94¾	60½	20	353	99½	94¾	59½
17	350	99½	94	60	21	351	99½	94⅛	59⅞
18	352½	99½	93¾	59½	22	347¾	99½	94	60

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

On the authority of the Secretary of the Treasury, we quote 100c. per oz. for silver, 1,000 fine, delivered at the option of the Director of the Mint to the New York Assay Office or to the mints in Philadelphia, Denver, or San Francisco, and proved to the satisfaction of the Treasury Department to have been mined, smelted, and refined in the United States. This quotation is retroactive to May 13.

Metal Markets

New York, Sept. 22, 1920

No encouraging factors are yet evident in the major metal market. London prices continue depressed and with exchange in the neighborhood of $3.50 any effort to raise prices here is fruitless. It is doubtful that the current year will see any material advances in metal prices, even though the present figures are, in many cases, at or below the cost of production.

Copper

Prices continue to trend farther away from those at which the larger producing interests are willing to sell. At least one large lot of metal has been sold during the last few days under 18c. f.o.b. refinery. Demand is spotty and sporadic and no evidences of any general buying movement can be detected. Inquiries for even small quantities have been few.

The foreign demand shows no appreciable change. France and Germany seem to be waiting for the settling of the indemnity question, before making any definite commercial programs. England is upset by the imminence of labor troubles which holds business in check.

Demand for forward delivery is absent but copper could doubtless be secured at little or no advance over the figures which we quote, which represent September and October delivery.

Lead

Lead is definitely weaker; the foreign importations have had a decided effect. It is not generally understood to what extent English metal has been coming into this country. In the first twenty days of this month, 5,700 tons of pig lead came into this port alone, from London. Adding to this 1,550 tons from Mexico and 350 tons from other countries makes 7,600 tons, a not inconsiderable amount, especially under the present market conditions. Brokers are offering this imported lead at 7¾@8c. New York without finding any great number of takers.

Large lots of lead have been sold at bargain prices, a considerable tonnage being marketed at 7½c., New York, for delivery during the next three months. Demand for prompt metal has been largely satisfied, but a premium over later deliveries is still asked by most sellers; 7¾@8c., New York, for prompt and 7½c. for forward delivery about represent what lead can be obtained for in the open market at present. Chemical lead is scarcer and a premium of ¼@½c. would be asked in most cases.

Zinc

Conditions are unchanged. Business is very dull indeed and the price seems fairly constant at current levels for all deliveries though the little demand that exists is for September or October. About 1,000 tons of European zinc is reported in the harbor here, the importers expecting to enter it duty free. There is little doubt, however, that they will have considerable difficulty in doing so. Domestic producers do not feel at all kindly about this imported metal, news of which came at a time when market conditions had just begun to improve.

Tin

Tin is very quiet and the market is irregular, with price changes of ¼@½c. for the same grade of metal on the same day. Indications are that certain dealers are under considerable pressure to sell. Electrolytic has been in fair demand for small lots at prices equal to, or ¼@½c. under, those for spot Straits.

Straits tin for future delivery: Sept 16th, 45.50@45.75c.; 17th, 45.75@46.00c.; 18th, 46.00@46.25c.; 20th, 45.25@45.50c.; 21st, 44.75@45.00c.; 22d, 44.75@45.00c.

Arrivals of tin in long tons: Sept. 13th, Penang, 225; 15th, Liverpool, 50; London, 25; 16th, Rotterdam, 25; London, 25; 18th, China, 20; Straits, 15; 20th, Singapore, 50; China, 175; London, 50; Liverpool, 50.

Silver

The silver market for the last week has been fairly steady, with business on a moderate scale only, owing to continued scarcity of offerings, and a not very keen demand for China account.

In the early part of the year, the Indian government prohibition against dealing with silver coin otherwise than as currency was cancelled, and the Indian traders are therefore again able to melt and use rupees in other form than coin. Exports of silver from San Francisco to the East, for the period Sept. 1 to 10 were 2,695,000 oz. Exports of silver from New York to London, for the period Aug. 21 to Sept. 1 were 243,170 oz.

Mexican Dollars—Sept. 16th, 71⅞; 17th, 71⅞; 18th, 71; 20th, 71⅝; 21st, 71⅞; and Sept. 22d, 71⅝.

Gold

Gold in London on Sept. 16th, 118s. 6d.; 17th to 22d incl., 117s. 6d.

Foreign Exchange

Sterling was firmer toward the end of last week but has reacted so that today's price is not far different from that obtaining a week ago. On Tuesday, Sept. 21st, francs were 6.63c.; lire, 4.32c.; and marks, 1.55c. New York funds in Montreal, 11 per cent premium.

Other Metals

Aluminum—For 50-ton lots: ingot, 99 per cent and purer, 35c.; 98@99 per cent, 34.8c. Virgin metal still obtainable in open market at about 32.5c. for 98@99 grade.

Antimony—Spot metal, 7¼c. per lb. Cookson's "C" grade, 12½@13c. Chinese and Japanese brands, 7@7½c. W. C. C. brand, 9@9½c. Chinese needle antimony, lump, firm at 7½@9c. per lb. Standard powdered needle antimony (200 mesh), 11½c. per lb. Market dull.

Bismuth—$2.55 per lb., 500-lb. lots, and $2.57 per lb., 100-lb. lots. Market quiet.

Cadmium—Nominal, $1.40@$1.50 per lb. Market steady.

Cobalt—Metal, $6 per lb.; black oxide, $4 per lb.; sulphate, $1.60. Market probably firm for some time.

Iridium—Nominal, $350@$400 per oz. Heavy demand, but small supplies.

Magnesium—Crude, 99 per cent or over pure, $1.75 per lb. for the metal in 100 lb. lots and over, f.o.b. Niagara Falls.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c., f.o.b. Bayonne, N. J.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $50@$75 per troy oz.

Palladium—$100@$110 per oz.

Platinum—Firm at $115 per oz.; $105 per oz. in 100 oz. lots.

Quicksilver—Market quiet; $75 per 75-lb. flask. San Francisco wires $75. Weak.

Ruthenium—$200@$220 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb. Demand strong.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—$35@$60 per kilogram, according to purity and gage.

Metallic Ores

Bauxite—About 52 per cent alumina content, less than 2 per cent iron oxide, up to 20 per cent silica and artificially dried to contain not more than 4 per cent free moisture, $10 per gross ton at mine; 54 per cent alumina and about 15 per cent silica, $11; averaging 57 per cent alumina, 8 to 12 per cent silica, less than 3 per cent iron oxide, $13 on basis of 8 per cent free moisture. Ores of very low silica content suitable for the manufacture of aluminum oxide and hydrate of alumina command a fancy price.

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a maximum of 6 per cent silica, 70@80c. per unit, New York. California concentrates, 50 per cent Cr_2O_3 and upward, 70@75c. California production has fallen off, even since May, owing to the low price, which does not permit operation of mines that were worked in 1918 when prices were $1.50 a unit for 50 per cent. The market is strengthening, and should prices rise some abandoned properties will be reopened. There are considerable tonnages of 40 per cent ore at different points in California, which are being held for prices of 50@60c. a unit, f.o.b. cars, California.

Iron Ores—Lake Superior ores, per ton, delivered at Lower Lake ports: Old Range bessemer, $7.45; Old Range non-bessemer, $6.70; Mesabi bessemer, $7.20; Mesabi non-bessemer, $6.55.

Manganese Ore—65@75c. per unit, seaport; chemical ore (MnO_2) $70@$90 per gross ton, lump; $80@$100 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 70@75c. per lb. of contained sulphide, New York.

[1]**Tantalum Ore**—Guaranteed minimum 60 per cent tantalic acid, 55@65c. per lb. in ton lots, against recent price of 65@70c.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 15c. per lb. for ore, with concessions on large lots or running contracts.

Tungsten Ore—Scheelite, 60 per cent WO_3 and over, per unit of WO_3, $6 f.o.b. mines; wolframite, 60 per cent WO_3 and over, per unit of WO_3, $5, in New York.

Uranium Ore (Carnotite)—$2.75@$3 per lb. for 96 per cent of the contained oxide (U_3O_8). Ores must contain a minimum of 2 per cent U_3O_8.

Vanadium Ore—$1.25 per lb. of V_2O_5 (guaranteed minimum of 11 per cent V_2O_5), New York.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

[1]**Zircon**—Washed, iron free, 5c. per lb.

[1]**Zirkite**—$90@$100 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 18—Zinc blende, per ton, high $49.90; basis 60 per cent zinc, premium $46; Prime Western, $45; fines and slimes, $42.50@$40; calamine, basis 40 per cent zinc, $36. Average settling prices: Blende, $45.60; calamine, $38.72; all zinc ores, $45.57.

Lead, high $109.05; basis 80 per cent lead, $100@$90; average settling prices, $105.10 per ton. Considerable lead tonnage shipped this week was purchased on $110 basis.

Shipments for the week: Blende, 12,995; calamine, 71; lead, 2,459 tons. Value, all ores the week, $853,830.

The zinc market was lifeless until today, with offerings of only $42.50 basis Prime Western. Today over 10,000 tons sold on a $45 basis. Offerings of lead dropped today to $90 basis, but the bulk of ore shipped was contracted on $100@$110 basis.

Platteville, Wis., Sept. 18—Blende, basis 60 per cent zinc, $49.75, contract, to $51, open market, base for high-grade. Lead ore, basis 80 per cent lead, $100 per ton. Shipments for the week: Blende, 969; calamine, 39; lead, 93 tons. Shipments for the year: Blende, 50,015; calamine, 2,399; lead, 4,208; sulphur ore, 1,241 tons. Shipped during week to separating plants: 2,569 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1, $2,400@$3,000; No. 2, $1,400@$1,700; spinning fibres, $400@$800; magnesia and compressed sheet fibres, $325@$400; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as Canadian royalty export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $12 per gross ton; ground (white) $23@$25; ground (off color) $16@$19 per net ton, f.o.b. Cartersville, Ga. Crude, 88 to 94 per cent, $23; ground (white) $45; ground (off color) $30@$32 per net ton, less than carload lots, f.o.b. New York. Crude, not less than 98 per cent, $11@$11.25 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—Domestic, extra light, 5@6c. per lb.; light, 4½@5½c.; heavy, 4@5c; English, extra light, 5@7c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $9@$12; washed, $12@$15; powdered, $18@$22; bags extra, per net ton, f.o.b. mines, Georgia; crude, $8@$12; ground.

$15@$40, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $25@$35; powdered, $30@$60, f.o.b. New York.

Feldspar—Crude, $8@$18 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $30@$35 car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $27.50, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $17.50, f.o.b. Tonuco, N. M.

Gypsum—Raw crushed rock, $3.50@$4 per ton; raw ground fine, $4@$4.50; calcined stucco, $9, all f.o.b. works. Containers extra. The last price quoted for plaster of paris in carload lots was $4.25 per 250-lb. bbl., f.o.b. mill, alongside dock, New York.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined — High-grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. Freshly ground calcined, suitable for flooring trade, $75@$85 per ton, f.o.b. Eastern points.

Dead-Burned — $32.50 per net ton, Chewelah, Wash.; $52@$58, Chester, Pa. Austrian grade, $52@$55 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica slightly stained, per lb.: No. 6, 50c.; No. 5, $1.20@$1.40; No. 4, $2@$3; No. 3, $4.25@$5; No. 2, $5.50@$7; No. 1, $8. Clear block: No. 6, 55c.; No. 5, $2; No. 4, $4; No. 3, $5.75; No. 2, $7; No. 1, $9; A1, $14; extra large, $25, all f.o.b. New York; ground, $100@$150 per ton, Philadelphia. Domestic, uncut f.o.b. Franklin, N. C., as follows: Scrap, $45@$50 per ton; punch, 4@5c. per lb.; circle, 15@25c.; 1½ x 2 in., 75c.; 2 x 2 in., $1.15; 2 x 3 in., $1.65; 3 x 3 in., $2.10; 3 x 4 in., $2.50; 3 x 5 in., $2.75; 3 x 6 in., $3.75; ground 165 mesh, $240 per ton; ground roofing mica, $60; mica washers, 75c.@$2 per lb.; 1¼-in. disks, No. 1, $1.60 per lb.; No. 2, $1.30.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, $35 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $13; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60. There is no price schedule for spot for domestic uses.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 17c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12@14c. Market improving.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17, all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines. F.o.b. Wausau, Wis., the price is $16 per ton in car lots, and $22 less quantities, including bags.

Sand (Glass)—Dry glass sand, $4 per net ton, f.o.b. cars Mapleton, Pa. Sand, f.o.b. Ottawa, Ill., is $3 per ton; $2.50 on annual contracts. Sand at Klondike, Gray Summit and Pacific, all in Missouri, is $2.50 on contract; some outside sales have been made at $4.

Sulphur—$18 per ton for domestic; $20 for export, f.o.b. Texas and Louisiana mines.

Talc — Paper making, $12@$22 per ton; roofing grades, $9.50@$15; rubber grades, $12@$18, all f.o.b. Vermont. California talc, $20@$45, talcum powder grade. Southern talc, powdered, carload lots, $12@$15 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $60@$70; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 15½c. per lb.; sulphide, powdered, 20@21c. per lb., f.o.b. works, carload lots.

Nitrate—Soda, $3.85 per cwt., ex vessel, Atlantic ports. Market quiet.

Potassium Sulphate—Domestic, $2.25@$2.50 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocarbontitanium—For 15 to 18 per cent material, $200@$250 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15. Foreign conditions as affecting the price of American goods remain unchanged.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 17@18c. per lb. of chromium contained; 4 to 6 per cent carbon, 19@20c. f.o.b. works.

Ferromanganese—For 76 to 80 per cent, prompt delivery, $200, freight allowed; last half, $170; English, $170@$175, c.i.f. Atlantic seaports. Spiegeleisen, 18@22 per cent, $80@$85, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50@$3 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $60@$65; 50 per cent, $82.50@$85; 75 per cent, $150@$160.

Ferrotungsten—70 to 80 per cent W, 90c.@$1.05 per lb. of contained tungsten, f.o.b. works.

Ferro-uranium—35 to 50 per cent U, $7 per lb. of U contained, f.o.b. works.

Ferrovanadium—Basis 30 to 40 per cent, $6.50@$9.50 per lb. of V contained, f.o.b. works.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

Metal Products

Copper Sheets — Current New York price, 29½c. per lb.; wire, 22½@23c.

Lead Sheets—Full lead sheets, 11c.; cut lead sheets, 12½c. in quantity, mill lots.

Nickel Silver—Unchanged at 39½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 26¾c.; sheathing, 25¾c.; rods, ⅜ to 3 in., 23¾c.

Zinc Sheets—$12.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 12c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Brick—$100@$110 per net ton, carload lots, eastern points; 9-in. straights, f.o.b. Baltimore, $100@$105.

Clay Brick — First-quality fire clay f.o.b. New Jersey, $75 per 1,000; second quality, 9-in. straights, f.o.b. Pennsylvania, Ohio and Kentucky works, $50@$55.

Magnesite Brick — 9-in. straights, f.o.b. Baltimore, $110@$120 per net ton.

Silica Brick—9-in., per 1,000, $65@$70, Chicago district; $65 Mount Union, Pa.

Iron Trade Review

Pittsburgh, Sept. 21, 1920

The pig iron and steel markets continue practically stagnant, but producers are well supplied with orders and production tends to increase rather than decrease. The industry is operating on its momentum and the outlook is that it will be able to continue for several months.

Cancellations of orders and instructions to defer shipment continue to be received, and attract considerable attention, but the volume is so small a percentage of the total business on books that producers are not incommoded. For instance, deliveries of sheets to the automobile industry are reduced by fully one-half from the high point, but the capacity released finds ready employment on orders already on books from other classes of consumers, and indeed the production of sheets is larger than for weeks, about 85 per cent of the mills being in operation, all that can secure steel supplies.

Pig Iron—The local market is stagnant, with practically no inquiry at all. Birmingham iron could be had for Pittsburgh delivery at more than $2 under the cost of Valley iron, but is not bought even at that. We quote: Bessemer and basic, $48.50; foundry and malleable, $50, f.o.b. Valley furnaces, with $1.96 freight to Pittsburgh.

Steel—Several sales of sheet bars have been made at $65, or $2.50 under previous sales, and further concessions could probably be secured. Billets are altogether inactive. We quote: Billets, $60; small billets, $65@$70; sheet bars, $65@$67.50.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls.; hardwood, 6c. per lb., in 250-lb. bbls.

Connellsville — Furnace, $16@$16.50; foundry, $17@$18.

Four Months of Dollar Silver

Treasury Department Has Purchased About One-fifteenth of 207,000,000 Oz. Required Under Pittman Act—Government's Purchases Are Serving to Stabilize Silver Prices and Can Prevent a Runaway Market—Oriental Demand for Silver Slackening

FOR FOUR MONTHS the country has been able to watch the effect of the repurchase clause of the Pittman Act upon the silver market. Over 14,000,000 ounces of silver produced in the United States were purchased during that period by the Treasury Department at $1 per ounce, of a total of 207,000,000 ounces to be bought. Difficulties in the way of the silver producer have been gradually eliminated to the satisfaction of both producer and the Government. Those smelters which treated both domestic and foreign silver-bearing ores have been able to take adequate and necessary precautions to guarantee the unquestionable domestic origin of all the silver sold by them at the official government quotation. The system is working smoothly and efficiently, and the difficulties encountered when repurchases first went into effect no longer have much importance.

Foreign and Domestic Markets Close Together

The great stabilizing influence of the Pittman Act in the silver market of the world is emphasized by the small differtial in price existing between the unvarying official domestic dollar quotation and the quotations in the foreign market which singularly enough have fluctuated but little. Except for two days, Aug. 20 and 21, when a quotation of $1.01⅜ was recorded, the price of silver in the foreign market has remained below the dollar level. On those dates the immediate and quantitative offerings of domestic silver acted as a safety valve, relieving the pressure upon the market that had raised the price. Thereafter and to date the price of silver has consistently stayed below the dollar price.

The silver bullion purchases of the Treasury Department are being stored by the Mints preparatory to being coined into silver dollars to replace those melted under authority of the Pittman Act and shipped to India. Although the act specifies that the silver dollars melted be recoined, no time limit has been designated and in view of the pressure upon the Mints of the country to meet the pressing demand for subsidiary silver coinage and gold coins (to replace those exported) there is little disposition to recoin silver dollars at this moment. At best the silver dollars would lie idle in the vaults of the Treasury, silver certificates circulating in their place. The Philadelphia Mint is storing the bulk of all the silver purchased. Until the demand for subsidiary coinage abates there will be no call for the coinage of silver dollars.

There is another angle of the Pittman Act which is worth considering in the event of a runaway silver market—some persons insist this may occur again. The act authorizes the sale of silver bullion for the purpose of providing silver for subsidiary coinage and commercial use as well as facilitating the settlement of adverse trade balances in silver. According to Director Baker of the Mint, in the event that the price of silver should rise over the parity point of subsidiary silver ($1.38) the Treasury Department could conceivably prevent the breaking up of the silver currency and its export or sale for bullion content, by selling part of the large accumulated stocks of silver. Last November, it will be recalled, the price of silver reached a record price of $1.37⅛ per oz. which was close to the danger mark, but it did not stay there long enough to cause any discomfort to the subsidiary currency system of the country. However, in December standard silver dollars, which were not held against outstanding silver certificates, were made available to certain American banks operating in China on presentation of any form of United States currency (not necessarily silver certificates). By this action, the government showed a method of preventing the exportation of subsidiary silver coins to other countries. The great stock of silver accumulated by the United States between 1878 and 1893, idle though it may have been and idle though it may become, was of great service to the United States during the war. Other countries that did not possess a surplus stock of silver coin or metal were unfortunately placed and could not prevent the widely prevalent melting of their coins except through decrees forbidding exportation of silver, or by debasing the silver currency.

In some quarters the impression has been gained that the chief function of the Pittman Act is to make the Government purchase silver at a higher figure than the metal can be obtained in the general world market. Attacks upon the measure usually ignore the history of the legislation and the behavior of the silver market during the past six years. The seemingly distressing feature of the situation whereby the Government is paying more for its silver than anyone else—although absolutely justified—is emphasized, but the possibility of using this same legislation to prevent a runaway silver market and protecting our currency for one thing is minimized.

The fact that other countries have had such a difficult time trying to keep silver currency in circulation is due not only to the avidity for hoarding exhibited by the people of European lands, but also to the fact that foreign silver currency because of its bullion value is worth so much more than depreciated paper currency using the same unit of value. A silver mark for its metallic content alone is many times more valuable than a paper mark worth say 2 cents. It is little wonder then that melted silver coins have been exported from Germany.

Less Dependence Upon Silver Coinage

Although the world is placing less dependence on metallic currency than ever before in modern times and the demand for silver for coinage purposes at the present time in European countries is negligible, sooner or later there must come a demand to replace the broken up and exhausted silver stocks of a country such as Germany. Nations are demonstrating ability to transact their business affairs without the aid of subsidiary silver coinage and are transferring former dependence upon this medium to such makeshifts as postage stamps and porcelain coins, to their own detriment, but as soon as financial order is established from the chaotic currency conditions abroad there should be a call for coinage silver once more.

Mexico is reported to be purchasing between one and two million ounces of silver per month at a premium of about 4 cents above the New York official price, which seems to be a rather stiff premium, in an attempt to meet currency requirements not fully met by local production. This action on the part of Mexico will aid the foreign market in maintaining the present level of prices as Oriental support is weaker. With quieter conditions in Mexico and a new regime that is functioning much better than the old, Mexico should once more become a steadily increasing silver producer.

India has become a seller of silver but whether this has been due to an unfavorable outlook for the Monsoon or an action made in anticipation of a possible decline in the market is conjectural. China is still counted upon to support the market but reports of poor harvest conditions in that country are disquieting. Furthermore, exports of Chinese goods are expected to decrease because of an oversupply of Chinese goods abroad, hence Oriental pressure on the market is expected to become lighter rather than heavier.

COMPANY REPORTS

St. Joseph Lead Co. Shows Profit for Six Months

Lead; Missouri

For the six months ending June 30, 1920, the St. Joseph Lead Co. reports net profits, after charges, but before Federal taxes, of $2,488,691, equivalent to $1.76 a share earned on the $14,094,660 capital stock (par value $10). Consolidated income and profit and loss account for the six months ended June 30, 1920, shows as follows:

Operating revenue	$3,266,841
Other income	116,787
Total income	$3,383,628
Charges	79,857
Net income	$3,303,771
Adjustments (credit)	6,392
Deductions	*821,472
Surplus	$2,488,691
Dividends	1,409,466
Balance	$1,079,225
Previous surplus	15,925,780
Total surplus	$17,005,005

* Includes $600,771 for depletion of ore reserves and mineral rights, and $120,265 adjustment of inventory value of matte, January 31, 1920.

New York & Honduras Rosario Mining Co. Has a Prosperous Year

Gold, Silver; Honduras

The annual report of the New York & Honduras Rosario Mining Co. for the year 1919 indicates a financially successful year. There was produced from 133,900 tons of ore 1,584,579 oz. of silver, and 10,200 oz. of gold in 1919, compared with 1,587,468 oz. of silver and 9,748 oz. of gold in 1918 from 129,900 tons of ore. The total value of the output increased from $1,782,428 in 1918 to $1,788,579 in 1919.

Dividends paid during the year amounted to $200,000 on a capitalization of 200,000 shares of $10 par value each, or 10 per cent. An amortization distribution of $200,000 was also made to stockholders.

The following statement shows the income and profit and loss for the year:

Production of gold and silver	$2,115,158.25	
Less—Freight and expense on bullion	62,065.30	
Operating income		$2,053,092.95
Operating expense		1,132,805.61
Operating profit		$920,287.34
New York administrative expense		76,368.28
Net income from operating		$843,919.06
Other income		147,996.53
Total income		$991,915.59
Deductions from income		58,828.99
Net profit for period		$933,086.60
Appropriated for reserves:		
Depreciaton	$64,315.44	
Taxes	106,610.63	
Fire insurance	4,020.70	
		174,946.77
Profit and loss balance—carried to surplus		758,139.83
Add surplus balance—January 1, 1919		2,434,065.59
Total		$3,192,205.42
Deduct—Reserve for depletion of mines in 1919	$334,750.00	
Dividends paid in year 1919	200,000.00	
		534,750.00
Surplus balance—December 31, 1919		$2,657,455.42

The ore reserves reported Dec. 31, 1919, were 283,422 tons valued at $4,279,649 (silver at $1 per oz.), compared with 282,559 tons valued at $3,812,419 in 1918. The development driven was 15,900 feet, compared with 11,266 feet in 1918.

Wolverine Copper Mining Co. Shows a Deficit for the Year

Copper; Michigan

The Wolverine Copper Mining Co. in its report for the year ending June 30, 1920, indicates that 3,932,255 lb. of copper were produced from ore averaging 0.764 per cent copper to the ton. Total operating cost per pound of refined copper was 15.283c.; cost of smelting, freight and marketing product, 2.055c.; taxes, 0.668c.; depletion of orebodies, 2c.; depreciation, 2.043c.; a total cost of 22.049c. per lb. of refined copper.

Sales of 3,457,320 lb. of copper at 19.11c. or $660,727.62 were made, but a loss of $98,297.73 was recorded, as the following table shows:

Sales:		
3,457,320 lbs. copper at 19.11c		$660,727.62
Cost of Sales:		
Copper on hand June 30, 1919, at cost	$72,015.16	
Operating expenses at mine as per statement hereafter	600,946.75	
Smelting, freight and New York and Boston expenses	80,818.54	
Taxes, exclusive of income and profit taxes	26,282.40	
Depletion of ore bodies	78,644.50	
Depreciation of equipment, etc	80,333.20	
	$939,040.55	
Less: Copper on hand June 30, 1920, at cost	180,015.20	
		759,025.35
Loss on sales of copper		$98,297.73
Deduct:		
Interest on Liberty Bonds	$24,450.00	
Other interest, etc	2,589.01	
	$27,039.01	
Less: Interest paid, etc	14,766.33	$12,272.68
Net loss for the year		$86,025.05

Three dividends were paid during the year of $30,000 each on the $780,000 capital stock of the company consisting of 31,200 shares of a par value of $25 per share.

Surplus on June 30, 1920, stood at $1,479,582.26, compared with $1,565,607.31 on June 30, 1919.

Shattuck Arizona Copper Co. Shows a Loss for the Second Quarter

Lead, Copper; Arizona

The report of the Shattuck Arizona Copper Co. for the quarter ending June 30, 1920, states that the production of metals for the quarter, especially copper, was badly handicapped as a result of shortage of mine labor. The lead mill operations were nearly normal, but lead production costs were high.

A summary of the production for the quarter is as follows:

Dry tons copper ore smelted	5,318
Dry tons lead concentrates smelted	3,719
Dry tons lead ores smelted	50

Metals Recovered From	Copper Ores	Lead Concentrates	Lead Ores
Pounds copper	631,567	.....	.....
Pounds lead	.....	1,753,244	.....
Ounces gold	133	933	7
Ounces silver	21,364	60,139	226

The copper production for the quarter is inventoried at 15c. per pound. The returns on lead are actual smelter settements.

The results of operations for the second quarter are as follows:

Copper ore, bullion and sales		$94,735.05
Copper ores, gold and silver, etc		21,213.15
Lead concentrates settlements		243,186.11
Interest		11,378.62
		$370,512.93
Copper operating expense and development	$172,752.37	
Milled lead expense	193,581.82	
Loss on sorted and direct lead ore settlements	34.07	
Administrative expense	12,811.44	379,179.70
		$8,666.77
Depreciation of mine and mill equipment		18,886.35
Loss for quarter, exclusive of depletion		$27,553.12

MINING STOCKS

Week Ended September 18, 1920

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Adventure	Boston	...	...	*50	...	
Ahmeek	Boston	58½	57½	58	Sept. '20, Q	.50
Alaska-B.C.	N. Y. Curb	1	⅞	1	...	
Allouez	Boston	23	23	23	Mar. '19,	1.00
Anaconda	N. Y.	55⅝	53½	55	Aug. '20, Q	1.00
Ariz. Com'l	Boston	10⅝	10½	10½	Oct. '18,	.50
Big Ledge	N. Y. Curb	1/2	1/16	1⅛	...	
Bingham Mines	Boston	9¼	8⅛	9¼	Sept. '19, Q	.25
Calumet & Ariz.	Boston	57½	56½	56½	Sept. '20, Q	1.00
Calumet & Hecla	Boston	285	280	285	June '20, Q	5.00
Canada Copper	N. Y. Curb	⅛	1/16	⅛	...	
Centennial	Boston	...	...	10½	Dec. '18, SA	1.00
Cerro de Pasco	N. Y.	44⅛	43	43⅞	Sept. '20, Q	1.00
Chief Consol.	Boston Curb	3⅛	3 3/16	3 3/16	Feb. '20, Q	.10
Chile Copper	N. Y.	15⅞	14⅝	15⅛	...	
Chino	N. Y.	29⅝	28⅛	29⅜	June '20, Q	.37½
Columbus Rexall	Salt Lake	*38	*36½	*37½	...	
Con. Ariz.	N. Y. Curb	...	...	⅛	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	...	...	2¼	...	
Copper Range	Boston	36⅛	35⅛	36⅛	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*42	*34	*40	...	
Davis-Daly	Boston	8⅜	8⅛	8⅜	Mar. '20, Q	.25
East Butte	Boston	11¼	10⅞	11	Dec. '19, A	.50
First Nat'l	Boston Curb	*85	*75	*80	Feb. '19, SA	.15
Frankl'n	Boston	2⅛	2⅛	2⅛	...	
Gadsden Copper	N. Y. Curb	*70	*65	*70	...	
Granby Consol.	N. Y.	37	37	37	May '19, Q	1.25
Greene-Cananea	N. Y.	29⅛	25	29¼	Aug. '20, Q	.50
Hancock	Boston	4⅛	4⅛	4⅛	...	
Houghton	Boston Curb	...	...	*40	...	
Howe Sound	N. Y. Curb	...	...	3⅜	July '20, Q	.05
Inspiration Con.	N. Y.	49⅛	47⅞	48⅜	July '20, Q	1.00
Iron Cap	Boston Curb	9	9	9	Sept. '20, K	.25
Isle Royale	Boston	28	28	28	Sept. '19, SA	.50
Kennecott	N. Y.	26⅛	25⅞	26⅛	June '20, Q	.50
Keweenaw	Boston	1 1/16	1 1/16	1 1/16	...	
Lake Copper	Boston	3⅛	3 1/16	3⅛	...	
La Salle	Boston	2⅛	2⅛	2⅛	...	
Magma Chief	N. Y. Curb	...	...	*21	...	
Magma Copper	N. Y. Curb	18	16	17	Jan. '19, Q	.50
Majestic	Boston Curb	...	...	*13	...	
Mason Valley	Boston	1⅛	1⅛	1⅛	...	
Mass. Con.	Boston	3⅛	3⅛	3⅛	Nov. '17, Q	1.00
Mayflower-O.C.	Boston	6⅝	6⅛	6⅛	...	
Miami	N. Y.	19⅝	19⅛	19⅜	Aug. '20, Q	.50
Michigan	Boston	...	...	3⅛	...	
Mohawk	Boston	61	60	61	Aug. '20, Q	1.50
Mother Lode (new)	N. Y. Curb	6	5⅜	5⅞	...	
Nevada Con.	N. Y.	12⅝	11⅝	12⅛	June '20, Q	.25
New Arcadian	Boston	...	...	2⅜	...	
New Baltic	Boston Curb	...	...	3	...	
New Cornelia	Boston	18⅛	17⅜	18⅛	Aug. '20,	.25
Nixon Nev.	N. Y. Curb.	...	...	*9	...	
North Butte	Boston	16⅜	16	16⅛	Oct. '18, Q	.25
North Lake	Boston	¼	¼	¼	...	
Ohio Copper	N. Y. Curb	...	...	3/16	...	
Oilbway	Boston	1⅛	1⅛	1⅛	...	
Old Dominion	Boston	24⅛	24⅛	24⅛	Dec. '18, Q	1.00
Osceola	Boston	39⅛	38½	39⅛	June '20, Q	.50
Phelps Dodge	Open Mar.	†195	†180	...	July '20, Q	2.50
Quincy	Boston	48	46½	48	Mar. '20, Q	1.00
Ray Con.	N. Y.	15⅞	15⅛	15⅛	June '20, Q	.25
Ray Hercules	Boston Curb	*75	*60	*62	...	
St. Mary's M. L.	Boston	42	40	41	June '20, K	2.00
Seneca	Boston	...	...	14⅞	...	
Shannon	Boston	1⅛	1⅛	1⅛	Nov. '17, Q	.25
Shattuck Ariz.	N. Y.	...	...	8⅛	Jan. '20,	.25
South Lake	Boston	...	...	2	...	
South Utah	Boston	*15	*15	*15	...	
Superior	Boston	4⅛	4⅛	4⅛	Apr. '17,	1.00
Superior & Boston	Boston	4⅛	4	4	...	
Tenn. C. & C.	N. Y.	10⅜	9⅞	10⅜	May '18, I	1.00
Tuolumne	Boston	*60	*55	*55	May '13,	.10
United Verde Ex.	Boston Curb	31	30½	31	Aug. '20, Q	.50
Utah Con.	Boston	8	7⅞	7⅛	Sept. '18,	.25
Utah Copper	N. Y.	65⅛	64	65	June '20, Q	1.50
Utah M. & T.	Boston	1⅛	1⅛	1 1/16	Dec. '17,	.30
Victoria	Boston	...	...	1⅛	...	
Winona	Boston	*40	*40	*40	...	
Wolverine	Boston	14	13¾	13¾	Jan. '20, Q	.50
LEAD						
Hecla	N. Y. Curb	4 3/16	4⅛	4⅛	June '20, QX	.20
St. Joseph Lead	N. Y.	16⅛	16⅜	16⅛	June '20, QX	.50
Stewart	Boston Curb	*13	*13	*13	Dec. '15,	.05
Utah Apex	Boston	1⅞	1⅞	1⅞	Nov. '18,	.25
ZINC						
Am. Z. L. & S.	N. Y.	12⅛	12	12⅛	May '17,	1.00
Am. Z. L. & S. pf.	N. Y.	46⅛	46⅛	46⅛	Aug. '20, Q	1.50
Butte C. & Z.	N. Y.	7⅛	7⅛	7⅛	June 18, I	.50
Butte & Superior	N. Y.	20	20	20	Sept. '17,	1.25
Con. Interst. Cal.	N. Y.	10⅛	9⅞	10	June '20, Q	.50
New Jersey Z.	N. Y. Curb	178½	177	177	Aug. '20, Q	4.00
Success	N. Y. Curb	*5	*4	*4	July '16,	.03
Yellow Pine	Los Angeles	*95	*90	*95	June '20, Q	.03

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	N. Y.	1⅜	1⅛	1⅜	...	
Alaska Juneau	N. Y.	1⅛	1⅛	1⅛	...	
Carson Hill	N. Y. Curb.	23½	23½	23½	...	
Cresson Consol. G.	N. Y. Curb.	1	⅞	1	June '20, Q	.10
Dome Ex.	Toronto	*38	*36½	*37½	...	
Dome Mines	N. Y.	11⅜	11⅛	11⅛	July '20, Q	.25
Golden Cycle	Colo. Sprgs.	‡...	...	*73	Sept. '20, Q	.02
Goldfield Con.	N. Y. Curb.	*10	*9	*9⅛	Dec. '19,	.05
Hedley	Boston	...	...	4¼	June '19,	.10
Hollinger Con.	Toronto	5.92	5.80	5.90	Sept. '20, X	.05
Homestake	N. Y.	...	...	49	Sept. '19,	.50
Kirkland Lake	Toronto	*53½	*49½	*50	...	
Lake Shore	Toronto	1.14	1.12	1.12	Oct. '19,	.02½
McIntyre-Porcupine	Toronto	2.07	2.00	2.05	Sept. '20, K	.05
Porcupine Crown	Toronto	*23½	*23	*23	July '17,	.03
Portland	Colo. Sprgs.	‡...	...	*60	July '20, Q	.01½
Reorgan. Booth	N. Y. Curb.	6	4	5	May '19,	.05
Silver Pick	N. Y. Curb.	*7	*5	*5½	...	
Teck Hughes	Toronto	*8	*7½	*7½	...	
Tom Reed	Los Angeles	1.05	1.04	1.04	Dec. '19,	.02
United Eastern	N. Y. Curb.	3¼	2 1/16	3¼	Apr. '20, Q	.21
Vindicator Consol.	Colo. Sprgs.	‡...	...	*18	Jan. '20, Q	.01
West Dome Consol.	Toronto	*6½	*6½	*6½	...	
White Caps Min.	N. Y. Curb.	*9	*7½	*8	...	
Yukon Gold	Boston Curb	...	...	1¼	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*20	*16	*17	Apr. '20, M	.03
Beaver Con.	Toronto	...	...	*41	May '20, K	.03
Coniagas	Toronto	...	...	2.55	Aug. '20, Q	.12½
Crown Reserve	Toronto	*25	*25	*25	Jan. '17,	.05
Kerr Lake	Boston	3¼	3 3/16	3¼	Sept. '19,	1.00
La Rose	Toronto	*35	*33	*33	Apr. '18,	.02
McKinley-Dar.	N. Y. Curb.	...	...	*55	July '20, Q	.03
Mining Corp.	Toronto	1.70	1.65	1.70	Sept. '20, Q	.12½
Nipissing	N. Y. Curb.	10	9⅞	10	July '20, Q	.25
Ontario Silver	N. Y.	6⅛	5⅞	6¼	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb.	1⅛	⅞	1	Jan. '12,	.10
Peterson Lake	Toronto	...	...	*14⅜	Jan. '17,	.01½
Temiskaming	Toronto	*35½	*34	*34	Jan. '20, K	.04
Trethewey	Toronto	*26	*25	*25	Jan. '19,	.05
GOLD AND SILVER						
Atlanta	N. Y. Curb.	*2	*1½	*2	...	
Barnes-King	Butte	‡...	...	1.11	Aug. '20, Q	.05
Bost. & Mont.	Boston	...	...	*63	...	
Cashboy	N. Y. Curb.	*9⅞	*8	*9	...	
El Salvador	N. Y. Curb.	1⅛	1⅛	1⅛	...	
Jim Butler	N. Y. Curb.	*16	*15	*16	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb.	*8	*5	*8	June '16,	.05
Louisiana Con.	N. Y. Curb.	⅛	⅛	⅛	...	
MacNamara M.	N. Y. Curb.	1/2	1/16	⅛	May '10,	.02½
N.Y. Hond. Rosar	Open Mar.	†13	†11	...	July '20, QX	.50
Tonopah-Belmont	N. Y. Curb.	1 1/16	1⅛	1 1/16	Jan. '20, Q	.05
Tonopah-Divide	N. Y. Curb.	2 1/16	1 15/16	2 3/16	...	
Tonopah Ex.	N. Y. Curb.	1 1/16	1 1/16	1 1/16	July '20, Q	.05
Tonopah Mining	N. Y. Curb.	1 1/16	1 1/16	1⅛	Oct. '19, SA	.15
West End Con.	N. Y. Curb.	1 1/16	1⅛	1 1/16	Dec. '19 SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb.	*21	*19	*20	July, '20, M	.01
Consol. M. & S.	Montreal	25½	25	25	July '20, Q	.62½
Daly Mining	Salt Lake	2.60	2.40	2.40	July '20, Q	.10
Daly-West	Boston	...	...	4⅛	July '20, Q	.25
Eagle & Blue Bell	Boston Curb	2 1/16	2 1/16	2 1/16	Apr. '20, Q	.10
Electric Point	Spokane	...	...	*30	May '20, SA	.03
Fed. M. & S.	N. Y.	12	11⅞	12	Jan. '09,	1.50
Fed. M. & S. pf.	N. Y.	35	33¼	34⅞	Sept. '20, Q	1.75
Florence Silver	Spokane	...	...	*35	Apr. '19,	.01½
Grand Central	Salt Lake	...	...	*37½	June '20, K	.03
Iron Blossom	N. Y. Curb.	½	½	½	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	...	...	3.97½	July '20, Q	.12½
Marsh Mines	N. Y. Curb.	*16	*14	*15	...	
Prince Consol.	N. Y. Curb.	⅜	5/16	⅜	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*12	*12	*12	Feb. '19,	.01
Rex Con.	N. Y. Curb.	*6½	*6	*6½	...	
South Heola	Salt Lake	*94	*93	*93	Sept. '19, K	.15
Stand. S. L.	N. Y. Curb.	½	½	½	Oct. '17,	.05
Tamarack-Custer	Spokane	2.35	2.30	2.30	Dec. '19, K	.03
Tintic Standard	Salt Lake	3.20	3.00	3.02½	June '20, Q	.10
Wilbert	N. Y. Curb.	*4	*3	*4	Nov. '17,	.01
NICKEL-COPPER						
Internat'l Nickel	N. Y.	19¾	19	19⅛	Mar. '19,	.50
Internat'l Nick.pf.	N. Y.	...	...	80⅜	Aug. '20, Q	1.50
QUICKSILVER						
New Idria	Boston	...	...	5	Jan. '19,	.25
TUNGSTEN						
Mojave Tungsten	Boston Curb	*9	*5	*9	...	
VANADIUM						
Vanadium Corp.	N. Y.	72⅛	67¼	71	July '20, Q	1.50
ASBESTOS						
Asbestos Corp.	Montreal	90	87	90	July '20, Q	1.50
Asbestos Corp. pf.	Montreal	100	99	100	July '20, Q	1.75
MINING, SMELTING AND REFINING						
Am. S. & R.	N. Y.	64⅛	59⅜	64	Sept. '20, Q	1.00
Am. S. & R. pf.	N. Y.	93	92⅜	93	Sept. '20, Q	1.75
Am. Sm. pf. A	N. Y.	72½	72¼	72½	July '20, Q	1.50
U. S. Sm. R. & M.	N. Y.	60	58	59⅜	July '20, Q	1.50
U.S.S.R.& M. pf.	Boston	44	43¼	44	July '20, Q	.87½

*Cents per share. †Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annually. BM, bimonthly. K, Irregular. I, Initial. X, includes extra

INDUSTRIAL NEWS

John A. Penton, president of Penton Publishing Co., is a director of the Wellman-Seaver-Morgan Co., Cleveland, Ohio.

Chain Belt Co., Milwaukee, Wis., announces that H. S. Rosenthal is now Southern District salesmanager for its Rex mixers and pavers.

Keystone Steel Co., 997 Union Arcade Building, Pittsburgh, Pa., has been organized to do a general brokerage business in iron and steel products.

The United American Metals Corporation, Brooklyn, N. Y., announce the death of their vice president, William H. Mixer, at his home in Berkeley, Cal. Mr. Mixer was one of the pioneers of his company.

The Jeffrey Manufacturing Co., Columbus, Ohio, announces the opening of a new branch office at 1108 Marine Trust Building, Buffalo, N. Y., to be in charge of H. W. Scott, formerly with the home office.

The Merrill Co., 121 Second St., San Francisco, Cal., call attention to the fact that their eastern office is in the Monadnock Building, Chicago, Ill., from which may be secured copies of catalogs and literature they issue.

F. B. Kirkbride, vice-president, has been elected president of SKF Industries, Inc., 165 Broadway, New York, succeeding B. G. Prytz, resigned, who has been elected managing director of the parent company, with headquarters at Gothenburg, Sweden.

The Blaw-Knox Co., Pittsburgh, Pa., steel products, will have an exhibit of clam shell buckets, water-cooled furnace appliances, and Prudential steel buildings at booth 308 of the American Foundrymen's Association exhibition in Columbus, Ohio, Oct. 4 to 8.

The Fawcus Machine Co., gears and mill machinery, has consolidated all departments in its new office building at 2818 Smallman St., Pittsburgh, Pa. A downtown office for meetings by appointment is maintained at suite 1501, Peoples Savings Bank Building.

D. D. Tripp, vice-president of Pioneer Rubber Mills, returned in May from his trip to China, Japan, the Philippines. He anticipates an unprecedented demand for mechanical rubber goods, and his mills are preparing to take care of a material increase in their oriental trade.

Walter H. Taverner, electrical and mechanical engineer, announces that he has severed his connection with the George A. Fuller Co., and is now with the Walter H. Taverner Corporation, 175 Fifth Ave., New York City, electrical and mechanical constructing engineers.

New York Testing Laboratories, 74-80 Washington St., New York City, L. R. Seidell, managing director, have been awarded the contract for the chemical, physical and electrical testing of approximately 400,000 ft. of signalling cable and wire for the city of Troy, N. Y.

The Koppers Co. and the **Aluminum Co. of America**, both of Pittsburgh, Pa., have jointly purchased the American Tar Products Co. and will operate it together. It is planned to manufacture electrodes for the use of the Aluminum company, as well as to continue the general tar-refining work.

Dwight P. Robinson & Co., Inc., engineers and constructors, New York City, has established a branch office in Youngstown, Ohio, in the Home Savings & Loan Building, in charge of Mr. C. I. Crippen. The Cleveland, Ohio, office has been moved from the *Leader-News* Building to the Citizens Building, and Mr. H. P. Clawson is in charge.

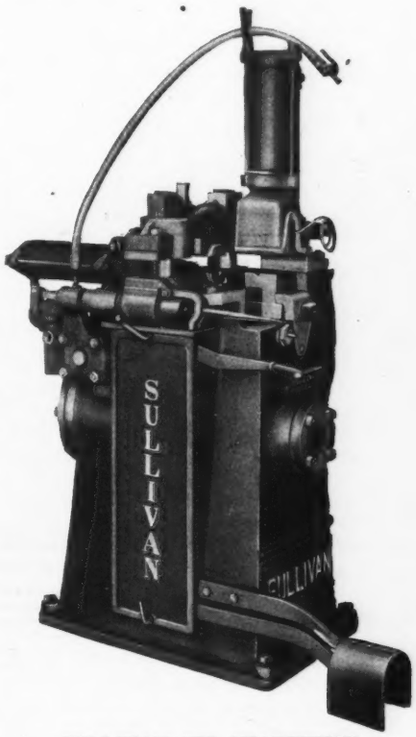
V. C. Kylberg has been appointed sales advisor to the Navy Department. During the period of greatest activity in the disposal of the War Department's surplus property, Mr. Kylberg was Assistant Chief of the Machine Tool Section of the Officer of the Director of Sales. Later he organized the Procurement Division for the Army's vocational training schools. More recently he has been acting head of the Sales Section of the U. S. Shipping Board.

The Oil Engine Manufacturers' Society held its annual meeting Aug. 10, in the club room of the Bessemer Gas Engine Co., at Grove City, Pa. The following were among the officers elected for the ensuing year: President, H. L. Dean, Chicago Pneumatic Tool Co.; Secretary, C. B. Humphrey.

New Small Hammer Sharpener Handles Solid or Hollow Steel

The success attained by the adaptation of the all-hammer process in sharpening and shanking drill steel, as incorporated in the Sullivan drill sharpening machine, has recently induced the manufacturers to design a new model sharpener, embodying the same principles but of smaller and lighter construction, suitable for making and sharpening bits on the steel used in the standard sizes of hammer drills.

This machine, which is shown in the accompanying illustration, is known as the Sullivan Class "B" sharpener, and is designed for handling solid or hollow steel of any section up to 1¼ in. in diameter, and to make bits up to a maximum gage of 2½ in.



SULLIVAN "B" SHARPENER

"B" SHARPENER, REAR VIEW

The Class "B" sharpener weighs 1,500 lb., occupies a floor area of 4 x 2¼ ft., and stands 5 ft. high. Its essential features consist of a horizontal hammer cylinder and piston, operating a dolly for upsetting, and a vertical cylinder and piston operating dies for swaging the drill bits or shanks. For upsetting, the steel is clamped in steel dies mounted in the lower, or stationary, and upper, or movable jaws of a yoke or vise operated by a horizontal air cylinder situated in the base of the machine.

The vise, or clamping cylinder and piston are of the differential type, the closing or clamping end being 10 in. in diameter, and the releasing end 4 in. in diameter. The horizontal movement of the piston is communicated to the vertical action of the vise by the air power acting through a toggle, or link. The combined effort of the air power

and toggle leverage is more than 50,000 lb., all of which is applied to hold the steel firmly in the vise.

The action of the vise is controlled by a valve placed in a valve chest on the side of the frame, and operated by a hand lever from the front of the machine. A safety stop is provided, which makes it impossible for the upsetting hammer to start until the steel is securely gripped by the vise.

The two-hammer cylinders are modified Sullivan "DR-6" drills, equipped with floating hammer pistons, and a valve motion which imparts a blow of great strength and liveliness to the dies and dollies.

In order to secure the advantages of the floating hammer piston a novel construction has been employed. Springs are provided to keep the upper swaging dies in a raised position when not in use. The foot lever, which operates the vertical hammer, is kept in a raised position by means of springs. When the lever is depressed, air is admitted to the cylinder and the hammer begins to strike.

In making or resharpening bits, the steel is shifted from one hammer to the other, being alternately upset and swaged until of the proper gage and shape, and the wings, corners, and cutting edge properly drawn out to be uniform, and of the right thickness and angle.

Equipment

The Class "B" sharpener is fitted with a drill steel punch for operating the hole in hollow steel bits and shanks. When the hole has been sufficiently opened, the steel is simply withdrawn and the punch stops operating.

The double taper bits can be accurately formed on the new Sullivan sharpener by means of an adjustable gage plate and dies which are operated by action of the clamping yoke or vise. Sixteen different gages can be provided by means of the gage plate, which is controlled by a key.

For cleaning hollow drill steel an automatic blowgun or jet is provided in the front end of the frame, below and to the left of the vertical hammer. A small nozzle will be noted, against which the hollow steel may be thrust, thus opening the valve, and permitting air to be blown through the steel. Exhaust air is also used for automatic cleaning jets in an ingenious manner from both the horizontal and vertical hammers, so that the working faces of the dies and dollies are kept clean and free from scale and accumulations of dirt and dust at all times.

The Sullivan "B" sharpener, light model, is operated by compressed air at a recommended pressure of 80 to 100 lb. While the machine is much lighter than the Sullivan heavy duty sharpener, it is built very substantially and with ample weight and area of parts where strength is needed, and where stress and strain occur. It will stand much hard work.

Why Foreign Markets Buy Outside the U. S. A.

Walter C. Teagle, head of Standard Oil of New Jersey, recently reported in *System* an important conversation he had on the subject of foreign markets. He gave many illuminating examples of the reasons why the United States fails to develop foreign markets. The most important conclusions he draws are summed up in *Current Opinion* for September, concluding with the admonition to send abroad "the manufacturer himself or at least a high executive wno fully knows the business, and can proceed on his own responsibility. . . . A man of resource and imagination. . . .

"One never knows what he is going to run into until he gets on the spot, and one of the reasons that our people so frequently fail in the building of export markets is that they insist on deciding everything ahead of time *and on American experience*, and then not only want matters to move according to schedule but to move immediately. When they fail they blame the market. They should blame themselves."

Outlook for Foreign Trade Better, Says Ingersoll-Rand Official

W. L. Saunders of Ingersoll-Rand Co., who is president of American Manufacturers' Export Association recently reviewed the outlook for foreign trade as follows:

"A few months ago there was cause for alarm in industrial conditions. Prices and bank loans were soaring, and it seemed to conservative business men that the shock of the war was not over; that we were riding for a fall. Being forewarned, the Government, the Federal Reserve Banks and the public determined to exert such reasonable pressure as might forestall drastic results. Restriction of expenditures by the Government, the issue of short-term certificates at market rates, the rise in the discount rate at the Federal Reserve Banks, and the determination on the part of the public that prices must come down or they would not buy, have resulted in a decided readjustment, which is now going on.

Cutting Wire Rope

A section devoted to "hoisting ropes" in the draft of a law to cover mine rules and regulations, proposed by the U. S. Bureau of Mines, is evidence of the extent to which the cutting of wire rope is now required in the maintenance of mine equipment.

The approved method of cutting the rope preparatory to resocketing and reclamping is the well-known oxy-acetylene process. There is no simpler or easier way. A typical outfit that has been found dependable comprises a standard Oxweld cutting blowpipe, a Linde oxygen cylinder, and a tank of Prest-O-Lite dissolved acetylene. With this equipment a competent operator cuts through a two-inch cable in about two minutes.

Dry Power Drills Prohibited in Rand Mines

Regulation Goes into Effect, April 1, 1921—Will Affect Many Drills

At a meeting held early in July in the offices of the Government Mining Engineer of the Union of South Africa, representatives of the Transvaal Chamber of Mines, the Mine Managers' Association, Underground Officials' Association, and of the South African Mine Workers' Union agreed that a new regulation should come into effect after March 31, 1921. This regulation, which is an amendment to No. 101 (1) (3) of "Mines, Works and Machinery Regulations," provides that "No person shall in the drilling of holes use or cause or permit to be used any machine drill in which only air is passed into the hole through the hollow jumper of the drill."

As the *South African Mining and Engineering Journal* says, the effect of this order on the mines remains to be seen. There are considerable numbers of dry jackhammers in use today on the Rand and also held in stock, and these will have to be scrapped or converted by the date mentioned. One estimate placed the cost of conversion at £9 per machine.

TRADE CATALOGS

Valves—The Merrill Co., 121 Second St., San Francisco, Cal., have just issued an illustrated 24-page catalog describing the Merco Nordstrom plug valve. The special construction of this valve permits forced lubrication of the sliding surface and the line of special lubricants supplied combine with the construction to make the valve specially interesting to mining and metallurgical companies. The pamphlet may also be secured from the eastern office in Monadnock Building, Chicago, Ill.

Furnaces—The Mine and Smelter Supply Co., 42 Broadway, New York City, and Denver, Col., have issued as their Bulletin No. 63, an elaborately illustrated catalog of 47 pages describing Massco furnaces for melting, hardening, forging, roasting and similar work. These furnaces are designed for low pressure oil fuel, gas or gasoline. Massco burners, blowers, gates, fans and Sil-O-Cel insulation are also described.

Flotation Machines — Southwestern Engineering Co., Hollingsworth Building, Los Angeles, Cal., mining and milling machinery, have issued a very fully illustrated pamphlet describing the K & K flotation machine, giving sample actual flow sheets embracing these machines and useful dots on local and export shipping dimensions. The ore listing laboratory of the company is also fully described. The publication is classed as Catalogue "C."